Environmental Impact Assessment Study Report for the 2Africa Kenya Landing Sites

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08 February 2022

Final

Quality information

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Revision History

Revision	Revision date	Details	Authorised	Name	Position
Issue 1 – DRAFT	04/05/2021	First DRAFT of the EIA report. Still incomplete as EIA studies (assessment and public participation) is still to be completed.			
Issue 2 – Draft	01-10-22	Draft for ASN Review			
Issue 3 – Draft	01-20-22	Draft for Consortium review			
Issue 4 – Final	02-03-22	Final for submittal			

Distribution List

# Hard Copies	PDF Required	Association / Company Name
10	Yes	National Environmental Management Authority

Document Authentication

This Environmental Impact Assessment (EIA) Project Report is submitted to National Environment Management Authority (NEMA) in conformity with the requirements of the amended Environmental Management and Coordination Act, 2015 and the Environmental (Impact Assessment and Audit) Regulations, 2003. The legislation requires that every development project listed in the Act assess the environmental, social and economic impacts and prepare an EIA report for approval by the Authority before the commencement of the project development.

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DECLARATION BY THE LEAD EIA/EA EXPERT:

I hereby certify that the contents of this EIA report for the proposed 2Africa fibre-optic cable have been prepared in accordance with the Environmental (Impact Assessment and Audit) Regulations, 2003 and that the methodology conform with the amended Environmental Management and Coordination Act, 2015.

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Airtel Networks Kenya Limited (Airtel) on behalf of 2Africa Consortium

DECLARATION BY THE PROJECT PROPONENT:
I hereby certify that the contents of this EIA report are correct and true to the best of my knowledge. I also confirm that the Project shall implement the Environmental and Social Management Plan and follow the mitigation measured provided in this report during the installation of the cable.

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On behalf of Airtel on behalf of 2Africa Consortium

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The EIA was conducted by AECOM's registered Lead and Associate experts in collaboration with other professionals with technical knowledge on submarine cables and stakeholder engagement.

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The practicing licences and CVs of the professionals can be found in Appendix A.

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Acronyms

2Africa	2Africa fibre-optic cable system project
ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area
AECOM	AECOM Professional Services Kenya (Pty.) Ltd and AECOM Africa Ltd.
Airtel	Airtel Networks Kenya Limited
AOI	Area of Influence
ASN	Alcatel Submarine Networks
BMH	beach manhole
BMU	Beach Management Unit
BWM	Ballast water management
CBO	community-based organisation
CC	County Commissioner
CEC	County Executive Committee
CGoM	County Government of Mombasa
CLS	Cable Landing Station
cm	centimetres
CO_2	carbon dioxide
COVID-19	novel coronavirus, COVID-19
dB	decibels
DCC	Deputy County Commissioner
DP	dynamic positioning
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
EMF	electromagnetic field
ESMP	Environmental and Social Management Plan
FAO	Food and Agricultural Organization of the United Nations
FBO	faith-based organisation
GHG	greenhouse gas
GOK	Government of Kenya
GPS	global positioning system
H&S	health and safety
HWM	high-water mark
Hz	Hertz
ICPC	International Cable Protection Committee
ICT	Information, Communications and Technology
IFC	International Finance Corporation
IMO	International Maritime Organisation
INNS	invasive non-native species
IUCN	International Union for Conservation of Nature
IWC	International Whaling Commission
KCGS	Kenya Coast Guard Services
KFS	Kenya Forest Services
kg	kilogram
kHz	kilohertz
km	kilometres
km^2	square kilometres
KMFRI	Kenya Marine and Fisheries Research Institute

KMMPA	Kisite-Mpunguti Marine Protected Area
KNBS	Kenya National Bureau of Statistics
KP	kilometre point
KPA	Kenya Ports Authority
KWS	Kenya Wildlife Service
LWM	low-water mark
m	metres
MARPOL	International Convention for the Prevention of Pollution from Ships
mm	millimetres
MNP	Marine National Park
MNR	Marine National Reserve
MoD	Ministry of Defence
MOU	Memorandum of Understanding
µPa	microPascal
MPA	Marine Protected Area
NEMA	National Environmental Management Authority
NGO	non-governmental organisation
NMK	National Museums of Kenya
NOx	oxides of nitrogen
OOS	out of service
OSHA	Occupational Safety and Health Act
OSMAG	Oil Spill Mutual Aid Group
PLGR	pre-lay grapnel run
PLIB	post-lay inspection and burial
PLSE	pre-laid shore end
Project	2Africa fibre-optic cable system project
RBA	Responsible Business Alliance
rms	root mean square
ROV	remotely operated vehicle
SPL	sound pressure level
SSL	sound source level
TOR	Terms of Reference
TTS	temporary threshold shift
UK	United Kingdom
UNCLOS	United Nations Convention on the Law of the Sea
WHO	World Heritage Convention
WIO	Western Indian Ocean
WRTI	Wildlife Research and Training Institute
WWF	World Wildlife Fund

Executive Summary

Proposed Project

The 2Africa (https://www.2africacable.com/) fibre-optic cable system project (2Africa or the Project) will span more than 37,000 kilometres, interconnecting Europe to Africa and the Middle East, with 35 landings in 26 countries, and will deliver increased capacity, quality and availability of internet connectivity to consumers and businesses.The 2Africa cable has recently added a new segment, known as the Pearls system, that will connect Africa, Europe and Asia. There will be direct connection from the Kenya branch to the Pakistan, Oman and United Arab Emirates landings.

The system is expected to be ready for service in 2023, delivering more than the total combined capacity of all subsea cables serving Africa today. 2Africa will deliver much-needed internet capacity and enhance reliability across large parts of Africa; supplement the fast-growing capacity demand in the Middle East; and underpin the further growth of 4G, 5G and fixed broadband access for hundreds of millions of people.

The system will have two landings in Kenya, both on the northern coast of Mombasa (Figure ES-1). These are referred to herein as ‘Mombasa North’ on Shanzu Beach and ‘Mombasa South’ on Nyali Beach.

2Africa will require installation and operation of submarine cables through the Exclusive Economic Zone and territorial sea of Kenya. Two branch cables from the system trunk will be laid by a cable-lay vessel until the ship reaches a shallow-water depth of around 15 metres. From this point, smaller vessels and divers will be used to install the cable in shallow water and pull the cable to shore. The Project will also involve the construction of two beach manholes (BMHs) (one per landing site) adjacent to the beach to facilitate the connection of the submarine component to the terrestrial portion of the Project. The beach and BMH sites will be restored to their original state after construction. The only element visible will be the 1-metre-diameter manhole covers.

The branching cables will be ‘landed’ on the beach and will each terminate at a BMH. The terrestrial portion of the Project will be installed from the BMH to a Cable Landing Station, where it will be connected to various configurations of terrestrial fibre-optic cable systems. The terrestrial portion of the Project will be completed by another entity and is out of scope for this study.

Objectives of the Environmental Impact Assessment

The Kenya Government policy on all new projects, programmes or activities requires that an Environmental Impact Assessment (EIA) be carried out at the planning stages of a proposed project. This is to ensure that significant impacts on the environment are taken into consideration during the design, construction, operation and decommissioning of the facility. The proposed Project will take place in a natural conservation area and in the ocean, thus triggering the requirement for an EIA. The categorisation of the Project was confirmed by Mr. Joseph Makau, a National Environment Management Authority (NEMA) representative in the Nairobi HQ office, on 26 June 2020.

The objectives of this EIA are to:

- identify elements of environment likely to be affected by the proposed Project and/or likely to cause adverse impacts to the Project, including both natural and man-made environments;
- identify and assess any potential losses or damage to flora, fauna and natural habitats; and
- identify the negative impacts and propose infrastructure or mitigation measures to minimise pollution, environmental disturbance, and social and economic impacts during cable installation and operation.

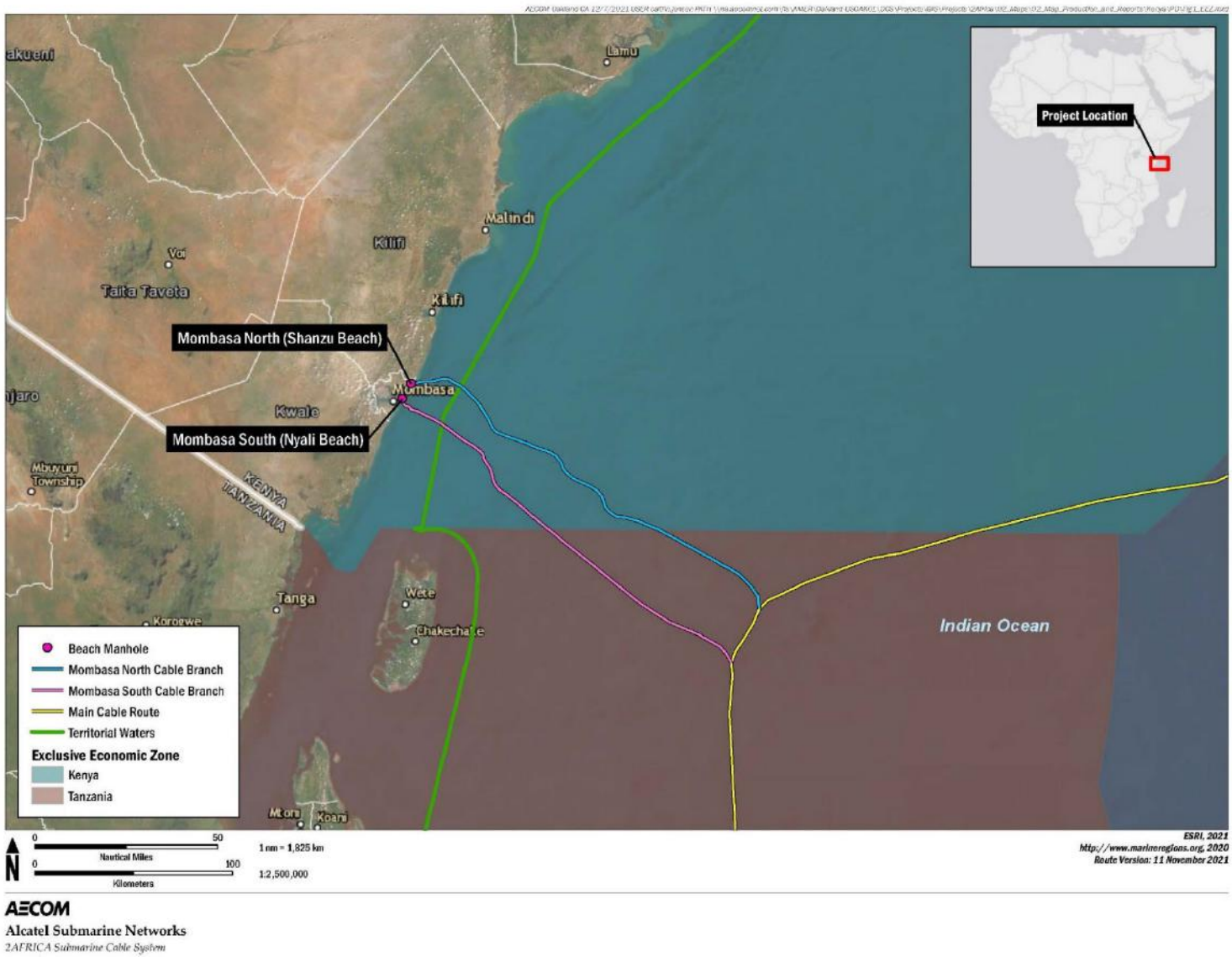


Figure ES-1: Cable branch routes in the Kenyan EEZ and landing site locations in Mombasa, Kenya

A Terms of Reference (TOR) for the proposed Project was prepared and submitted to NEMA in May of 2021. Following acceptance of the TOR, the EIA for the 2Africa Project (Kenyan landing sites) has been carried out in line with the requirements of the Environmental Management and Coordination Act (EMCA) 2015 and Environmental (Impact Assessment and Audit) Regulations, 2003, among other relevant laws.

Project Alternatives

The identification and analysis of project alternatives is a requirement of the EIA process, as outlined in Regulation 16 (b) of Environmental (Impacts Assessment and Audit) Regulations, 2003.

The preferred route for the branch cables and the preferred landing sites that are presented in this EIA were selected after an extensive desktop and field analysis of alternative options in an earlier phase of the Project. This analysis included consideration of sensitive environments and habitats, seafloor substrate, and other factors, including feasibility of the connection between the trunk cable and the landing sites. For this reason, alternative options (*e.g.*, alternative routes, landing sites or cable technologies) are not presented here as Project options, having already been eliminated because they were not feasible. The alternatives considered and reason for elimination are presented in Table 4-1 in Chapter 4 of this report.

Therefore, the only alternative to that described in this report would be the option of not implementing the activity, or the 'No Project' alternative. Under the 'No Project' alternative, the Project would not take place. This would mean that the anticipated negative impacts resulting from the proposed installation and operation would not occur. Similarly, the anticipated positive socioeconomic impacts—*e.g.*, increased broadband, internet connectivity and telecommunications capacity for Kenya—would also not occur. The demand for internet connectivity is rising in the country as a result of e-commerce and the digital education programmes. Improved telecommunications options are in line with Kenya's Vision 2030 and the Big4 Agenda.

Baseline Information

Baseline information for the Project Area of Influence was collected via desktop literature searches and site visits. Site visits to the two landing sites were undertaken in October 2020 and October 2021; additional visits were conducted during the public consultation phases of the Project to incorporate stakeholder input into the baseline analysis. In addition, two specialist studies were undertaken for the Project: a marine survey of geophysical and geotechnical characteristics of the proposed cable corridor was undertaken by Fugro Germany Marine GmbH in 2021; and a Marine and Coastal Ecology Study was completed by the Wildlife Research and Training Institute in 2021.

Impact Identification and Assessment

The assessment methodology takes into account the requirements of the Kenyan EMCA, 2015, as well as relevant best international practices, including the United Kingdom (UK) Institute of Environmental Management and Assessment and the UK Chartered Institute of Ecology and Environmental Management.

The EIA identified the potential positive and negative biophysical and socioeconomic impacts across the Project life cycle (namely the design phase, the installation phase and the operational phase). The magnitude of these potential impacts was evaluated by considering their duration, reversibility and scale. The significance of these impacts was determined in a matrix that considered the magnitude and the receptor sensitivity.

Most of the Project's negative impacts are likely to occur during the construction and installation phase, such as the disturbance to marine life, vessel traffic, air pollution and resuspended sediments. No negative impacts are anticipated during the operation phase, except in the unlikely event of a cable repair. The proposed Project will have positive economic impacts during its operation phase, such as better internet connectivity, leading to more employment opportunities. A summary of the impact findings for the EIA is provided in Table ES-1.

Table ES-1: Summary of impacts

Activity	Impact	Phase	Significance
Vessel Usage	Increase in vessel traffic and temporary access restrictions	Installation	Minor
	Introduction of invasive non-native species	Installation	Minor
	Discharge and emissions from vessels	Installation	Minor
	Underwater noise and disturbance	Installation	Minor
	Accidental leaks and spills	Installation	Minor
	Interaction between vessels and marine megafauna	Installation	Moderate
	Use of anchoring in shallow waters	Installation	Minor
	Visual disturbance from vessels	Installation	Negligible
Route clearance	Disturbance by resuspension of sediment	Installation	Negligible
	OOS cable disposal onshore	Installation	Negligible
Pre-lay grapnel run	Disturbance by resuspension of sediment	Installation	Minor
	Debris disposal onshore	Installation	Negligible
Cable lay in deep water	Benthic habitat disturbance	Installation	Minor
Cable lay in shallow water	Benthic habitat disturbance	Installation	Minor
	Impacts on coral and seagrass habitat	Installation	Moderate
Cable landing	Disturbance to terrestrial habitat and species	Installation	Moderate
	Beach parking and access constraints	Installation	Moderate
	Access restrictions for local fishermen	Installation	Minor
	Nuisance to beach users	Installation	Minor
	Construction emissions	Installation	Negligible
	Accidental spills and leaks	Installation	Minor
	Disruption to existing infrastructure	Installation	Minor
	Community health and safety	Installation	Minor
Operation and Maintenance	Presence of the cable on the seabed	Operation	Minor
	Electromagnetic fields	Operation	No Impact
	Cable repairs	Maintenance	Minor
	Socioeconomic enhancement	Operation	Positive Impact

Note:
OOS = out of service

Mitigation Measures and Environmental and Social Management Plan

The Project will implement a suite of best-management practices or 'in-built mitigation' designed to avoid or reduce potential impacts on sensitive receptors. These measures have been captured in the impact ratings assigned above. Additional mitigation measures have been proposed for some impacts, in particular those that would affect receptors with higher sensitivity (*e.g.*, sensitive species or local communities), and where a targeted mitigation measure can readily be applied to reduce the likelihood or magnitude of impact. The proposed mitigation measures are presented in the impact assessment and summarised in an Environmental and Social Management Plan (ESMP). The ESMP will support successful implementation of the Project while respecting and conserving the social and environmental aspects of the country.

Conclusions and Recommendations

Although the magnitude of most Project impacts is minor, four activities were assessed to have potential impacts of moderate significance, largely due to the sensitivity of the receiving environment. The additional mitigation measures listed in Table ES-2 are therefore recommended for these activities.

Table ES-2: Additional mitigation measures

Activity	Impact	Additional Mitigation
Vessel Usage	Interaction between vessels and marine megafauna	• A Marine Megafauna Protocol shall be developed and implemented in coordination with KWS; this may include, for example, a response plan in the event of megafauna collision. • A safety zone and/or speed restriction will be implemented on the sighting of pods of whale species, bait balls (*i.e.*, large, tightly packed formations of fish) or slow-moving megafauna such as Whale Sharks.
Cable lay in shallow water	Impacts on coral and seagrass habitat	• The cable installer will coordinate with KWS in advance of and during the pre-lay swim, to refine the cable alignment in the Mombasa MNR. • Cable installation in the vicinity of coral habitat will take place within appropriate sea-state conditions and tidal conditions (*i.e.,* water level at the reef); to be defined in consultation with KWS.
Cable landing	Disturbance to terrestrial habitat and species	• Turtle nest monitoring will be conducted within the Project footprint prior to installation to check for turtle nests and recent turtle activity. The timing (*i.e.*, days in advance of beach works) and details of turtle monitoring will be coordinated with KWS to meet Kenyan requirements. If active nests and/or nesting attempts are observed by monitors, appropriate mitigation measures—for example, temporary fencing and monitoring during beach works—to avoid nest disturbance will be taken by the Project in consultation with KWS.
	Beach parking and access constraints	• A 2-week notice period will be provided to surrounding businesses, traders and hotels, alerting them to the planned duration and schedule of installation work. The local community and beach users will be informed of the planned installation activities through local radio stations, newspaper adverts, public notices or other similar means. • The BMH installation will be scheduled to avoid peak season holiday periods, if possible.

Notes:

BMH = beach manhole
BMU = Beach Management Unit
KWS = Kenya Wildlife Service
m = metre
MNR = Marine National Reserve

Residual impact ratings have been provided in the text for any impacts with **moderate** or higher significance. With implementation of the additional mitigation measures outlined here, all residual impacts of the Project are expected to be of **minor** significance or less. Therefore, it is our recommendation that the Project be authorised, provided the mitigation measures are adhered to as outlined in the ESMP.

1. About this Study and Report

This document is the output of the Environmental Impact Assessment (EIA) Study for the proposed 2Africa (https://www.2africacable.com/) fibre-optic cable system project (2Africa or the Project) in Kenya. This study is being submitted to the National Environment Management Authority (NEMA) as part of the application process for an environmental licence for the Project. This EIA includes the Kenyan marine element of the Project only. Environmental assessments and other applicable permitting procedures for cable installation and landings in other countries in the 2Africa system are being applied for through the relevant national government entities.

A NEMA-registered EIA Lead Expert and Associate Expert, working in partnership with AECOM Professional Services Kenya (Pty.) Ltd and AECOM Africa Ltd. (collectively referred to as AECOM), has prepared this EIA for the Project (Kenya branch cables and landing sites only).

1.1 Objectives of the EIA

The objectives of this EIA are to:

- identify elements of the environment likely to be affected by the Project and/or likely to cause adverse impacts to the Project, including the natural and man-made environment;
- identify and assess any potential losses or damage to flora, fauna and natural habitats; and
- identify negative impacts and propose infrastructure or mitigation measures to minimise pollution, environmental disturbance, and social and economic impacts during cable installation and operation.

1.2 Scope of the EIA

The Kenya Government policy on all new projects, programmes or activities requires that an EIA be carried out at the planning stages of a proposed project. This is to ensure that significant impacts on the environment are taken into consideration during the design, construction, operation and decommissioning of the facility.

The EIA study for the 2Africa Project (Kenyan landing sites) has been carried out in line with the requirements of EMCA 2015 and Environmental (Impact Assessment) and Audit regulations 2003, among other relevant laws.

The tasks undertaken in preparation of this EIA report include:

a. collecting baseline information of the proposed Project area;
b. describing the proposed Project;
c. identifying and describing the legislative and regulatory framework applicable to the Project;
d. identifying and assessing environmental and social impacts that may arise from the Project. development and operations;
e. identifying occupational health and safety concerns during the installation of the cable;
f. public participation;
g. proposing feasible mitigation measures;
h. developing an Environmental and Social Management Plan (ESMP); and
i. preparing and submitting an Environmental and Social Impacts Assessment report to NEMA.

The current application for an environmental license for the Project includes activities and infrastructure associated with the marine portion of the cable, including the nearshore and beach installation, and the construction of a beach manhole (BMH).

1.2.1 Structure of the Report

Table 1-1 presents the EIA study report structure, as outlined in section 18 of the Environmental Regulations (2003) and indicates where this information can be found in this report.

Table 1-1: Contents of an Environment Impact Assessment study report as outlined in section 18 of the Environmental Regulations, 2003

Section 18 (1)	Contents Required by the Environmental Regulations, 2003	Section
(a)	The proposed location of the project	Chapters 2 and 33
(b)	A concise description of the national environmental legislative and regulatory framework, baseline information	Chapter 5
(c)	Any other relevant information related to the project; the objectives of the project	Chapter 2
(d)	The technology, procedures and processes to be used, in the implementation of the project	Section 3.3
(e)	The materials to be used in the construction and implementation of the project	Section 3.3
(f)	The products, by-products and waste generated project	N/A
(g)	A description of the potentially affected environment	Chapter 8
(h)	The environmental effects of the project, including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated	Chapter 10
(i)	Alternative technologies and processes available and reasons for preferring the chosen technology and processes	Chapter 4
(j)	Analysis of alternatives, including project site, design and technologies and reasons for preferring the proposed site, design and technologies	Chapter 4
(k)	An environmental and social management plan proposing the measures for eliminating, minimising or mitigating adverse impacts on the environment; including the cost, time frame and responsibility to implement measures	Chapter 11
(l)	Provision of an action plan for the prevention and management of foreseeable accidents and hazardous activities in the cause of carrying out activities or major industrial and other development projects	Chapter 11
(m)	The measures to prevent health hazards and to ensure security in the working environment for the employees and for the management of emergencies	Chapter 11
(n)	An identification of gaps in knowledge and uncertainties which were encountered in compiling the information	Section 1.4
(o)	An economic and social analysis of the project	Section 10
(p)	An indication of whether the environment of any other state is likely to be affected and the available alternatives and mitigating measures	N/A
(q)	Such other matters as the Authority may require	N/A

1.3 Approach

1.3.1 Screening

The Project was screened to determine the need to undertake an EIA based on:

- the characteristics of the proposed Project activities;
- the characteristics of the Project area (and area of influence [AOI]); and
- the Second Schedule (as amended) of the Government of Kenya's EMCA (1999 and 2015), which lists three categories of projects—telecommunications infrastructure is listed as a Medium Risk Project requiring a submission to NEMA (see Section 5.1 for more detail).

Based on the above-listed criteria, it was concluded that an EIA would be required. The categorisation of the Project was confirmed by Mr. Joseph Makau, a NEMA representative in the Nairobi Headquarters office, on 26 June 2020. Due to the nature of the Project, it is required that a full EIA assessment be undertaken. A Terms of Reference (TOR) report was therefore prepared and submitted to NEMA on 17 May 2021.

1.3.1.1 Terms of Reference Report

A TOR report for the proposed Project was prepared in accordance with the following legal framework:

- General Guidelines for Conducting EIAs in Kenya, in accordance with Environment (Impact Assessment and Audit) Regulations, 2003
- Environmental (Impact Assessment and Audit) Regulations, 2003
- Environment Impact Assessment Guidelines and Administrative procedures, 2002

Under these regulations, an EIA report is required to be prepared and submitted to the Authority prior to the commencement of the Project. The TOR for this proposed Project included, but is not limited to, the following:

- a comprehensive description of the Project, including location, materials and technologies used and the process of installing the cable;
- identification of potential environmental and social impacts of the Project and provision of mitigation measures;
- identification of relevant regulations relating to the Project, both international and national; and
- provision of an analysis of the Project alternatives.

The TOR report was submitted to NEMA on 17 May 2021. NEMA requested additional information from the consultants who wrote the TOR report, and this was duly responded to. NEMA approved the TOR report on 28 June 2021 and instructed the EIA study to proceed.

1.3.2 Desk-Based Review and Baseline Collection of Data

A literature review was undertaken to gather a background understanding of the Project and the Project area. This step also included a review of the Kenyan legislation and policies, as well as environmental impact reports from other studies—both on a similar topic and in the geographic location of the proposed 2Africa sites. These latter steps were undertaken to determine the baseline conditions and establish the legal, institutional and biophysical/socioeconomic environmental setting of the Project area.

This step also included a review of the findings from the initial site visit (October 2020) undertaken during the scoping phase. The remote sensing data gathered were ground-truthed by the consultants who undertook both the initial and second site visits, (October 2021).

1.3.3 Site Visits

1.3.3.1 Initial Site Visit

An initial site visit was undertaken on 27 and 28 October 2020 to gather detailed environmental and social baseline data, and to undertake preliminary stakeholder engagement. Information regarding the proposed Project was shared via a Project Description document/summary note (sometimes referred to as the Project's Background Information Document). The consultants used this visit to identify formal stakeholders and request their views/comments on the proposed Project. The team also undertook focus group discussions with the Area Chief, village elders and Beach Management Units (BMUs) at both locations.

Site walkovers were also undertaken; the consultants used the global positioning system (GPS) to identify the two landing sites for the cables in Mombasa; took photographs of the areas and undertook informal meetings with beach users in the Project areas.

Further information about the stakeholders who were engaged during this site visit can be found in Chapter 6.

1.3.3.2 Second Site Visit

Similar to the first site visit, the consultants undertook stakeholder interviews and site walkovers. This site visit occurred from 5 through 8 October 2021. By this time, further design elements of the cable, the route and the landing sites had been confirmed by the Project Proponent.

The public consultation meetings were also undertaken during this visit. Further information about the stakeholders who were engaged during this site visit, as well as summaries from these meetings, can be found in Chapter 6.

1.3.4 Specialist Studies

To support the baseline understanding of the Project area, two specialist studies were commissioned:

1. **A marine survey** was undertaken to better understand the bathymetry/submarine topography of the proposed cable route so that areas obstacles/objects and potential areas of interest (*e.g.*, shipwrecks) could be avoided by the cable. For further information on this survey, see Section 7.1.

2. **A marine ecological impact assessment** was undertaken to review and assess the coastal and marine environment crossed by the cable route through the Mombasa Marine National Park (MNP) and the Mombasa Marine National Reserve (MNR), respectively. Existing information and expert opinions were solicited regarding the animals, corals and other components of the marine and coastal ecosystem to better understand the area and assess the impacts of the Project. A site visit was conducted to assess the existing terrestrial environment at the beach landing sites. See Section 7.2 for further information on the findings of this survey/assessment.

The findings of both these studies were also used in assessing the potential impacts of the Project, as well as identifying possible mitigation measures.

1.3.5 Stakeholder Engagement

In accordance with Regulation 17 of the Environmental Regulations, 2003, stakeholder engagement is a mandatory process. The consultants adhered to NEMA's guidelines and regulations.

Best international practices (World Bank, International Finance Corporation [IFC] and Japan International Cooperation Agency) require public consultation and a disclosure process leading to Social and Environmental Assessment and Management Systems; these practices were also undertaken by the consultants.

Details on the stakeholder engagement process can be found in Chapter 6.

1.4 Assumptions, Limitations and Gaps in Knowledge

In undertaking this investigation and compiling the EIA, the following assumptions and limitations have been identified:

- The information provided by the Project Proponent, cable system designer and installer is accurate, up-to-date and complete.
- The information provided by subject matter specialists is accurate, sufficient and unbiased.
- Face-to-face stakeholder engagement was impacted by the novel coronavirus, COVID-19 (COVID-19) pandemic. A mix of virtual and in-person meetings were undertaken as part of the stakeholder engagement associated with the Project.
- Any limitations and gaps in knowledge that have been encountered by the specialists are identified in the specialist reports.

2. 2Africa Subsea Cable Project

2.1 High-Level Overview of the Project

Title of the Project: 2Africa Submarine Cable System (Kenya branches)

Project Proponent: Airtel Networks Kenya Limited (Airtel) on behalf of the 2Africa Consortium

- PIN number: P051131780Q
- Address: P.O. Box 73146-00200 Nairobi, Parkside Towers Mombasa Road
- Contact person: Mr. Henry Nyang'or, Director – Supply Chain Management, SCM

Location of the Project: Mombasa, Kenya

The 2Africa cable system will span more than 37,000 kilometres (km), interconnecting Europe to Africa and the Middle East, with 35 landings in 26 countries, further improving connectivity into and around Africa (Figure 2-1). The 2Africa cable has added a new segment, known as the Pearls system, that will connect Africa, Europe and Asia. There will be direct connection from the Kenya branch to the Pakistan, Oman and United Arab Emirates landings. The system will have two landings in Kenya, both in Mombasa. As with other 2Africa cable landings, capacity will be available to service providers at carrier-neutral data centres or open-access cable landing stations on a fair and equitable basis, encouraging and supporting the development of a healthy internet ecosystem.

Figure 2-1: 2Africa overview (excluding the Pearls extension)
Source: ASN

Nature of the Project: laying of a submarine telecommunications cable and landing of the cable (in two locations) on the Kenyan shoreline.

2Africa will require installation and operation of submarine cables through the Exclusive Economic Zone (EEZ) and territorial sea of Kenya. The Project will also involve two separate shore-end cable installations in the Mombasa nearshore and beach environment, and construction of two BMHs on or adjacent to the beach to facilitate the connection of the submarine components to future terrestrial cable components.

The system is expected to be ready for service in 2023, delivering more than the total combined capacity of all subsea cables serving Africa today. 2Africa will deliver much-needed internet capacity and enhance reliability across large parts of Africa; supplement the fast-growing capacity demand in the Middle East; and underpin the further growth of 4G, 5G and fixed broadband access for hundreds of millions of people.

The activities associated with the installation of the fibre-optic cable system in Kenya are listed in the Amended EMCA (2015) (NEMA 2015) as potentially having a negative impact on the environment and as requiring an environmental license from the NEMA.

Area of Influence: The AOI for this Project is defined as the geographic area likely to be affected directly by the Project facilities and activities; indirectly as a secondary effect of a direct effect; and as a result of an unplanned event such as an accident.

Under this definition, the direct AOI is the footprint of the main trunk cable route within the Kenya EEZ; the Mombasa North (Shanzu Beach) and Mombasa South (Nyali Beach) branch cable routes to the BMHs; and the BMHs and associated temporary construction areas.

Further information on the Project can be found in Chapter 3.

2.2 History of Submarine Cables

Historically, international telecommunication was carried by submarine telegraph cables, radio and other analogue channels. Submarine telegraph cable was first used around the 1850s and fibre-optic submarine cables in the 1980s, revolutionising the way international communications is conducted. Fibre-optic submarine cables now carry up to 95 percent of international voice and data traffic (ICPC 2016). In Kenya, there are several submarine cables that land in Mombasa. These include the East African Marine System (TEAMS), the Eastern Africa Submarine Cable System (EASSy), the Lower Indian Ocean Network (LION2) and SEACOM, as well as the planned DARE-1 and PEACE cables. These cables have provided the country and other East African countries with improved internet bandwidth.

2.3 Project Objectives and Justification

The level of broadband traffic has been growing in the past three decades. Consumer appetites for new applications like cloud computing, on-demand video and social media has driven the growth. The demand for new connectivity is driven by a business environment in which ultra-broadband access is essential for sustainable growth and development. The purpose of the Project is to significantly increase the capacity, quality and availability of internet connectivity within Kenya and to the rest of the world. Kenya is among the fastest-growing economies in Sub-Saharan Africa, with an average economic growth of 5.7 percent per year as of 2019. The economic expansion experienced in the current decade has been boosted by a stable macro-environment, positive investor confidence and a resilient service sector. The digital economy has propelled the economic growth, with new and existing businesses operating on the digital space (World Bank 2020).

The Information and Communication Technology sector in Kenya has grown an average of 10.8 percent annually since 2016, becoming a significant source of economic development and job creation. However, for the country to keep up with the emerging digital innovations and demand for digital connectivity such as the Digital Learning Programme and business environment, digital transformation is required.

2Africa's objective is to directly connect numerous countries around the entire coast of Africa, Europe, and the Middle East region, benefitting both businesses and consumers by enhancing capacity and reliability for internet services, video conferencing, advanced multi-media and fixed broadband access. The Project will also underpin future mobile and fixed broadband access. This will help African leaders to implement their 2030 visions and meet many of the Sustainable Development Goal challenges related to or depending on internet connectivity. In Kenya specifically, digital enhancements will support

the Government of Kenya in delivering some of its objectives under Kenya's Vision 2030, including telecommunications improvement (GOK 2007).

2.4 Parties Involved in 2Africa Kenya System and Landing

The 2Africa system is being developed by a consortium composed of global and national telecommunications companies, internet service providers and global technology companies (known as the 2Africa Consortium). The 2Africa representative in Kenya is Airtel. Airtel is the designated Landing Provider and the Project Proponent for the purposes of environmental permitting.

The Project team for the EIA includes the following entities:

- Alcatel Submarine Networks (ASN) has been contracted by the 2Africa Consortium to engineer, manufacture and install the 2Africa submarine cable system.
- AECOM has been contracted to undertake all environmental and social licencing/permitting processes, which includes application for an EIA License from NEMA.
- Norken International has been contracted by AECOM as the local partner to lead stakeholder engagement.

3. Kenya Branch Cables and Landing Sites

The proposed cable route runs along the seabed in Kenya's territorial sea and the EEZ before reaching land in Mombasa (see Figure 3-1). A view of the nearshore cable routes is shown on Figure 3-2. According to the Constitution and the National Lands Act, this land is public land. It is understood that consent from the National Lands Commission will be required for the use of the seabed for the branching cables and the trunk cable that passes through the Kenya EEZ, in accordance with the National Lands Act.

In Kenya, the proposed Project **has two landing sites in Mombasa**: Mombasa North (Shanzu Beach) and Mombasa South (Nyali Beach).

The following sections will provide further information on each of the proposed Project landing sites.

3.1 Mombasa North (Shanzu Beach) Landing

The Mombasa North (Shanzu Beach) BMH site is shown on Figure 3-3. Project activities at the landing site at Shanzu Beach will include construction of a BMH and earth plate, as well as burial of the sea cable and connection to the BMH, which will serve as the connection point to the terrestrial components of the system. The approximate coordinates of the BMH are 03° 58.4610'S, 039° 45.0438'E. The approximate coordinates of the earth plate are 03° 58.442'S, 39° 45.084'E. The locations of both the BMH and earth plate are approximate to allow for flexibility in the event that stakeholder input or engineering constraints require minor shifts in the final locations (for example, to avoid existing infrastructure). The location is adjacent to the PrideInn Paradise Beach Resort and Hotel, and the Serena Beach Resort and Spa (Figure 3-4). The area around the landing site appears to be easily accessible from a public access road that leads directly to the proposed BMH location. The site is 13 km northeast of central Mombasa and is approximately 25 km from Moi International Airport. The beach is public land.

An engineering marine survey was conducted for the Project in 2020. This entailed surveying the bathymetry and geology along the route and identifying areas of interest to be avoided in the cable-laying process. The Mombasa North (Shanzu Beach) findings included the presence of shell fragments, corals, boulders, depressions, and in-service cables. A detailed overview of the survey can be found in Appendix B. The findings from the marine survey were incorporated into the final cable route selected and were taken into consideration in this EIA.

Development permits for construction of the BMHs will be sought from the Lands Office in Mombasa County.

3.2 Mombasa South (Nyali Beach) Landing Site

The Mombasa South (Nyali Beach) landing is approximately 9 km southwest of the Shanzu Beach landing site. It is on the popular (public) Nyali Beach, which is approximately 15 km from Mombasa's Moi International Airport. The BMH site is on the public access road off Nyali Beach at coordinates 04˚ 03.0100'S, 039˚ 42.4150'E. The earth plate is at coordinates 04˚ 03.036'S, 039˚ 42.476'E (Figure 3-5).The locations of both the BMH and earth plate are approximate to allow for flexibility in the event that stakeholder input or engineering constraints require minor shifts in the final locations. Photographs of the Mombasa South (Nyali Beach) BMH site are shown on Figure 3-6.

An engineering marine survey of the proposed cable route was conducted by a marine survey contractor in 2020. Seabed conditions for the Mombasa South (Nyali Beach) landing included course sediment over subcropping rock, with isolated boulders and seagrass. A detailed overview of the survey can be found in Appendix B. The findings from the marine survey were incorporated into the final cable route selected and were taken into consideration in this EIA.

Development permits for construction of the BMHs will be sought from the Lands Office in Mombasa County by the Project Proponent.

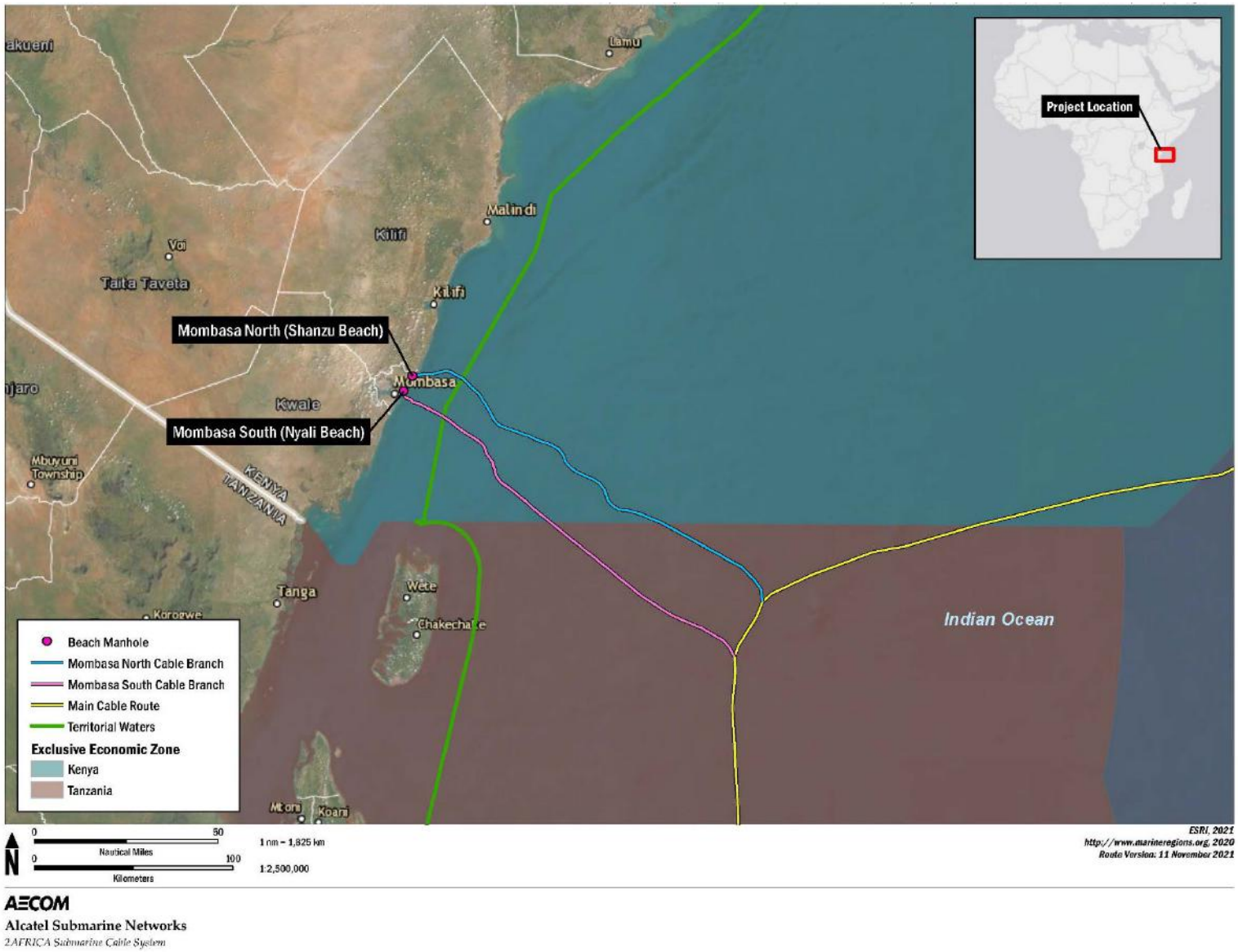


Figure 3-1: Cable branch routes in the Kenyan EEZ and landing site locations in Mombasa, Kenya

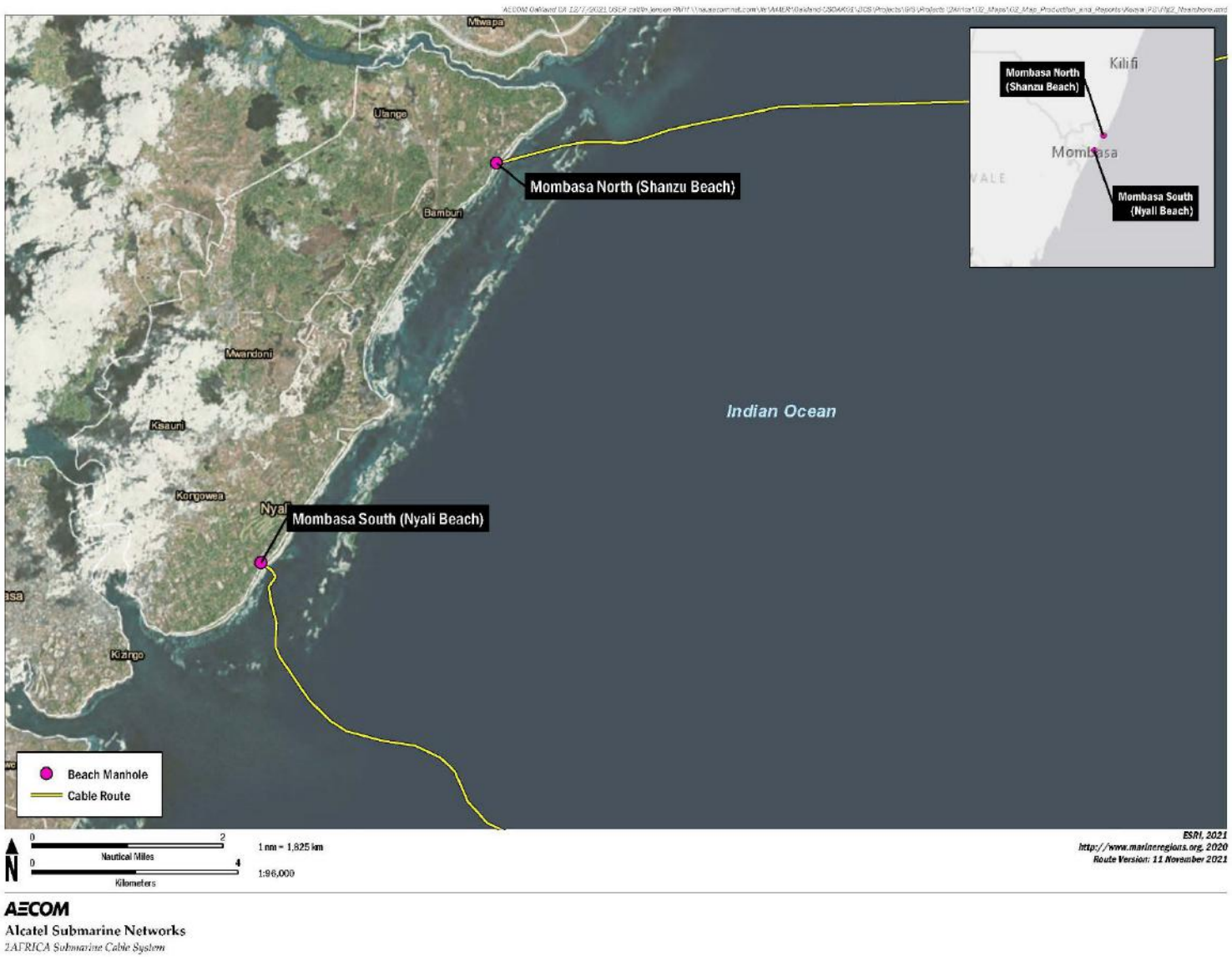
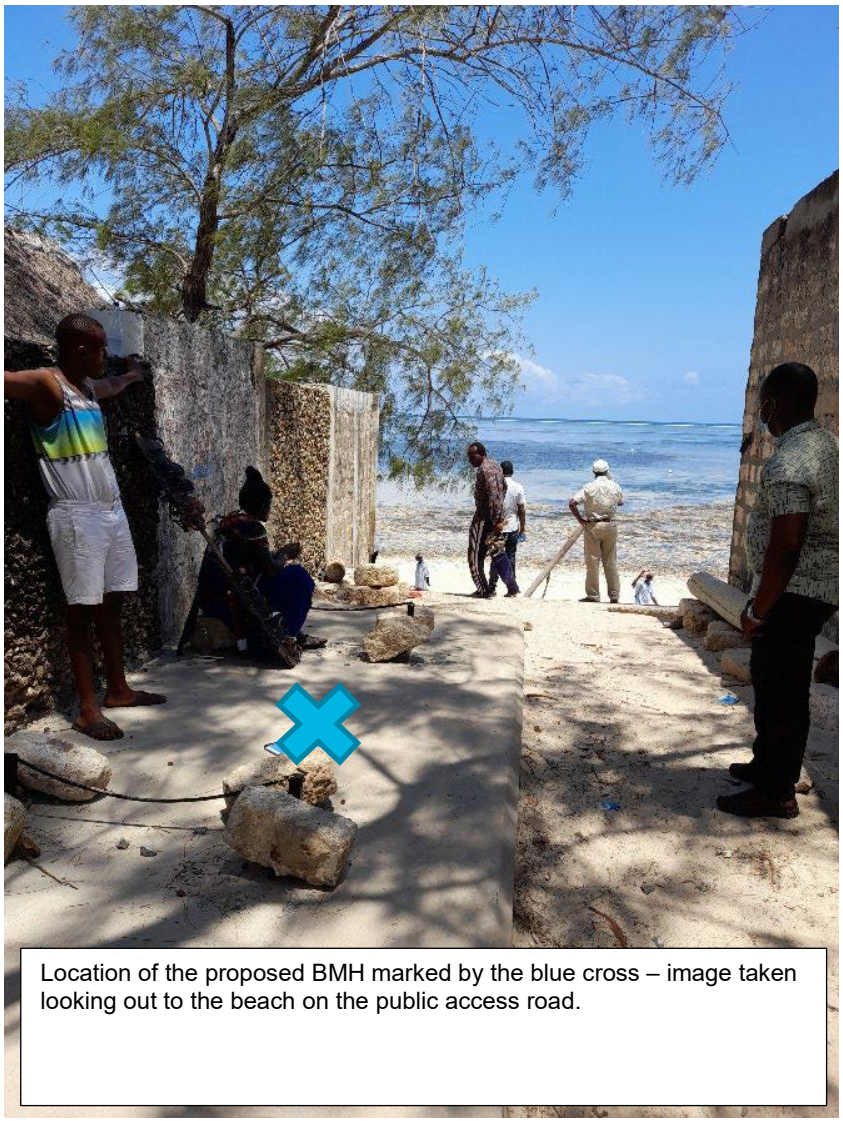


Figure 3-2: Nearshore branch routes and landing site locations in Mombasa, Kenya

Figure 3-3: Mombasa North (Shanzu Beach) foreshore cable route, BMH, landing site and earth plate



Location of the proposed BMH marked by the blue cross – image taken looking out to the beach on the public access road.

Location of the proposed BMH marked by the blue cross – image taken looking up the public access road; the beach is behind.

Figure 3-4: Photograph of the proposed Mombasa North (Shanzu Beach) BMH location

Source: AECOM

Figure 3-5: Mombasa South (Nyali Beach) foreshore cable route, BMH, landing site and earth plate

Figure 3-6: Photograph of the proposed Mombasa South (Nyali Beach) BMH location

Source: AECOM

3.3 Technical Description of the Project

3.3.1 Overview

The 2Africa fibre-optic cable system involves the installation of two branch submarine cables in Kenya's EEZ and territorial sea, with landings at two beaches in the Mombasa area (Figure 3-7).

The two branch cables from the main cable system trunk (which is outside the Kenyan EEZ) will be laid by a cable-lay vessel until the ship reaches a shallow-water depth of around 15 metres (m). From this point, smaller vessels and divers will be used to install the cable in shallow water. The Project will also involve the construction of two BMHs (one per landing site) adjacent to the beach to facilitate the connection of the submarine component to the terrestrial portion of the Project. The beach and BMH sites will be restored to their original state after construction. The only element visible will be the 1 m-diameter manhole covers.

The terrestrial portion of the Project is outside the scope of this EIA. The terrestrial component includes installation of the cable from the BMH to a Cable Landing Station (CLS), where it will be connected to various configurations of terrestrial fibre-optic cable systems.

Further technical information on the Project activities can be found in the following subsections.

3.3.2 Planning Activities

This section provides information about the technologies being used as well as the processes that will take place during the different phases of laying the submarine cable.

3.3.2.1 Cable Route Engineering and Planning

Identifying the most optimal route for the cable is known as 'cable route engineering.' This is developed during the route planning process. The landing site is selected to:

- optimise the approach of the cable to the beach infrastructure;
- minimise interference with any existing cables or other seabed users;
- minimise impacts on sensitive species, habitats and cultural resource features; and
- use the seafloor features that effectively function as a natural corridor for the cable route.

The cable route is engineered to avoid potential hazards, other seabed user's assets and disruption to marine resources and operations, and to secure long-term protection of the cable. The cable route and Project design are developed and refined through two main stages:

- The desktop study includes a detailed review of all factors affecting the routing of the cable, including physical, environmental, socioeconomic, and regulatory aspects. This will form the basis for the cable route survey activities—the detailed seafloor mapping of the final submarine cable route.

- The cable route survey includes shallow and deep-water surveys of the route. Bathymetric and other data are collected and analysed to determine the optimum route for cable installation. Seabed samples are taken as required to help the classification of seabed sediments. Cone penetrometer tests are performed in areas of soft sediment where cable burial by ploughing is desired for cable protection.

Figure 3-7: Overview of the two landing sites in Mombasa

During the planning phase of the cable system, the marine survey and route selection exercises are optimised to ensure that a route is chosen that minimises impact on the seabed as much as reasonably practicable during the installation phase. During the cable route survey, modifications will be made to find the optimum route.

Due to the technology that is used to perform the burial installation, it has always been beneficial for the route to follow areas of seabed where there is sufficient sediment. The sediment should ideally be of a nature that is good for both ploughing and providing adequate protection to the installed cable from external threats.

This typically means that areas of rough topography (rocks and boulders) and undulating bathymetry (sand waves and pockmarks) are avoided, if possible. By selecting ground that provides good conditions for the burial operation, the impact on the seabed is kept to a minimum because the amount of force required to penetrate the seabed is minimised.

Cable route engineers will then engineer the cable type to suit the selected route. This means that the cable type will vary with cable depth, seabed type and cable burial location.

This activity was undertaken for the proposed cable route for the Project to identify the best route before the installation phase.

3.3.2.2 Cable Technology and Types

The proposed cable is an optical fibre subsea cable, designed with materials to minimise environmental impact. The cable design accommodates optical fibres, which are housed in an inert jelly-filled stainless-steel tube, surrounded by two layers of steel wires that form a protective vault against pressure and external contact, and provide tensile strength.

This vault is then enclosed in a hermetically sealed conductor tube and insulated with a layer of polyethylene, metallic screen and outer sheath to form the basic 23-millimetre (mm)-diameter deep-sea lightweight protected 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 repair operations. A secondary function is that its metallic elements are used to feed an electric current to power signal boosters and can be used to localise cable breaks.

For shallow water applications, external layers of steel armour wires are added to suit route conditions and installation methods; and to protect the cable from external forces such as seismic activity, ship's abrasion and fishing activity.

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 cable is serviceable once rejoined.

These high performances are made possible because of a cable structure that isolates fibres from mechanical stresses under normal operation conditions. This is achieved through a design in which fibres lay freely in a steel tube. As a result, the cable can house many types of fibre, provided they can pass a tensile strength proof-test.

Cable Types

Cable size will vary in width from 17 mm (lightweight cables used at a water depth of 1,500 to 6,000 m) to 50 mm double-armoured heavy cable used at water depths of 0 to 100 m, on the beach and rocky shores where burial cannot occur. Table 3-1 and Figure 3-8 highlight the outside diameter of the fibre-optic cable according to the protection choice (*i.e.*, cable type).

Table 3-1: Cable diameters

Cable Type	Outside Diameter (mm)	Typical Installation Depth (m)
Light Weight	17	1,500 to 6,000
Light Weight Protected	23	1,500 to 4,500
Single Armour Light	28	0 to 1,500
Single Armour Heavy	38	0 to 900
Medium Double Armour	37.5	0 to 200
Rock Armour Heavy	49	0 to 100
Double Armour Heavy	50	0 to 100

Source: ASN

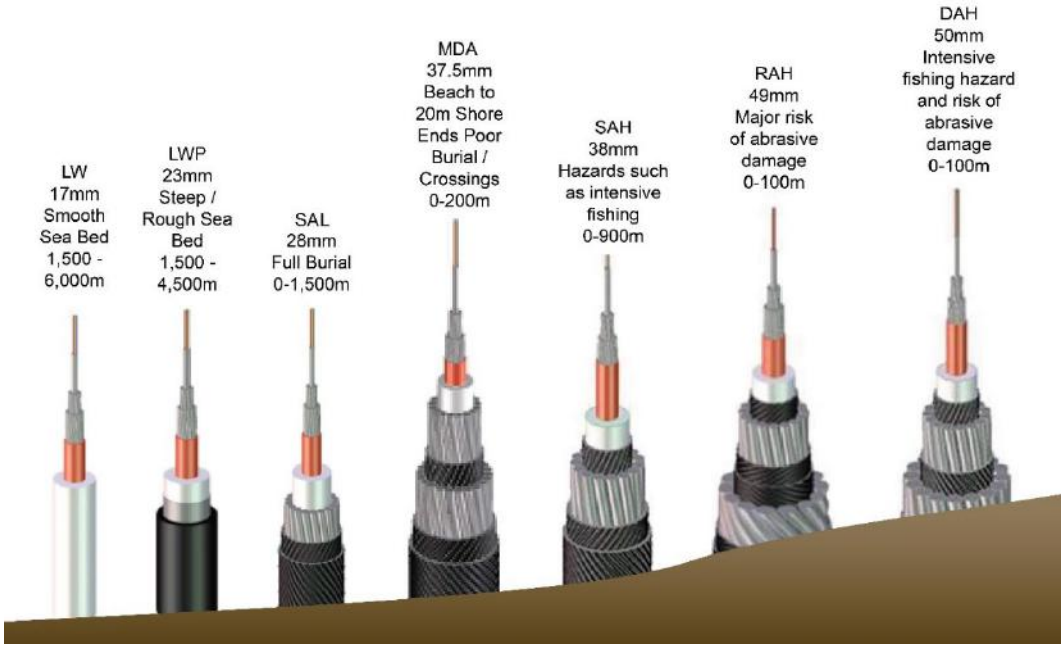


Figure 3-8: Overview of the different cable types for the 2Africa Project with their thickness and depth of use

Source: ASN 2021

Repeaters

Repeaters are optical amplifiers that are installed along the cable to boost the signal (Figure 3-9). The repeaters are designed with the following features:

- The diameter of the rigid sea-case (the white tube section shown in Figure 3-9) is approximately 270 mm.
- The length of the sea-case section of the repeater is approximately 980 mm.
- The total length of the repeater is approximately 3,900 mm to 4,240 mm, depending on the cable coupling.

Figure 3-9: Cable repeaters

3.3.2.3 Protection Measures for the Cable

Articulated Pipe

Articulated pipe may be installed on cables from the BMH/end of seaward ducts towards the sea and should, as a minimum, reach the low-water mark (LWM). Where burial is not possible in the surf zone, and if additional cable stability is required, articulated pipe may be fitted over the cable to avoid cable abrasion. At this time, the Project is anticipating that approximately 300 m of articulated pipe will be applied at the Mombasa South (Nyali Beach) landing, and 900 m of articulated pipe at the Mombasa North (Shanzu Beach) landing.

Where deployment of articulated pipe is likely to be to 2 m water depth, as is the case for the Kenya landings, it will typically be applied by divers. In some situations, articulated pipe may be pre-installed aboard the installation vessel during the 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 pipes onboard the main lay vessel can be in part (critical surf area only) or in full. Figure 3-10 shows the articulated pipe normally used by ASN.

PS055/500/09

Specifications

Segment Length - Overall	546mm
Effective Installed Length/Segment pair	500mm
Minimum Internal Diameter	55mm - for cables up to 47mm Dia
Maximum External Diameter	130mm
Wall Thickness	9mm
Material	Ductile Iron to AS1831 / ISO 1083
Tensile Strength / Elongation	400MPa / 12%
Impact Resistance	12m Drop test or 26kg
Minimum Bend Diameter	4.0m
Weight per Segment	8.1kg
Weight per Installed metre (air)	16.4kg
Weight per Installed metre (water)	14.3kg

Figure 3-10: Articulated pipe used by ASN and its specifications

Clamps

The cable or articulated pipe may be secured with clamps if necessary (*e.g.*, to prevent further lateral movement of the cable or articulated pipe in high-energy surf zones) (Figure 3-11, Figure 3-12, Figure 3-13 and Figure 3-14). To provide additional stability, saddle clamps may be installed by divers at suitable intervals along the articulated pipe, where seabed conditions permit. Clamps will only be considered on hard ground in high-energy surf zones where there is a significant risk of cable movements, or as required to avoid impacting sensitive resources. At most cable landings, the cable route heading is perpendicular to the dominant wave front, rendering the sideways drag component minimal.

Saddle clamps for articulated pipe are normally made of the same material as the articulated pipes themselves.

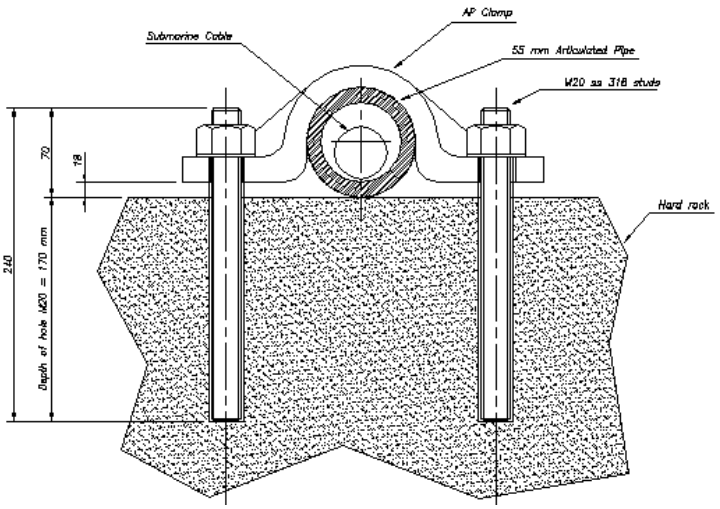


Figure 3-11: Articulated pipe clamps

Figure 3-12: Example of saddle clamp installation (two-rod anchor)

Figure 3-13: Example of cable clamp installation (one-rod anchor)

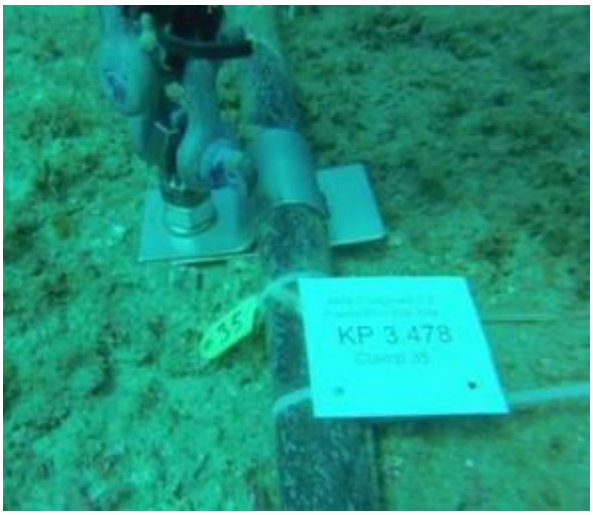


Figure 3-14: Clamp installed in rock with kilometre marker

The current design for the Kenya landings does not include clamps, because the tension and weight of the cable (at >6 kilogram [kg] per metre) will keep the cable in place on the seabed under the conditions (current speed) observed during the cable route survey. If, during installation or post-installation inspection, the engineer determines that clamps would be beneficial as a precaution, they would be installed.

3.3.3 Cable Installation Activities

This section describes the work methods, tools and resources[1] normally used in connection with submarine cable installation.

3.3.3.1 Cable Installation Vessels

A typical main-lay cable-lay vessel is represented by ASN's own purpose-built 'Ile de Class' vessels. These vessels are typically 140 m long and 23 m wide, with an 8 m draft and a weight of 9,820 metric tonnes (Figure 3-15 and Figure 3-16).

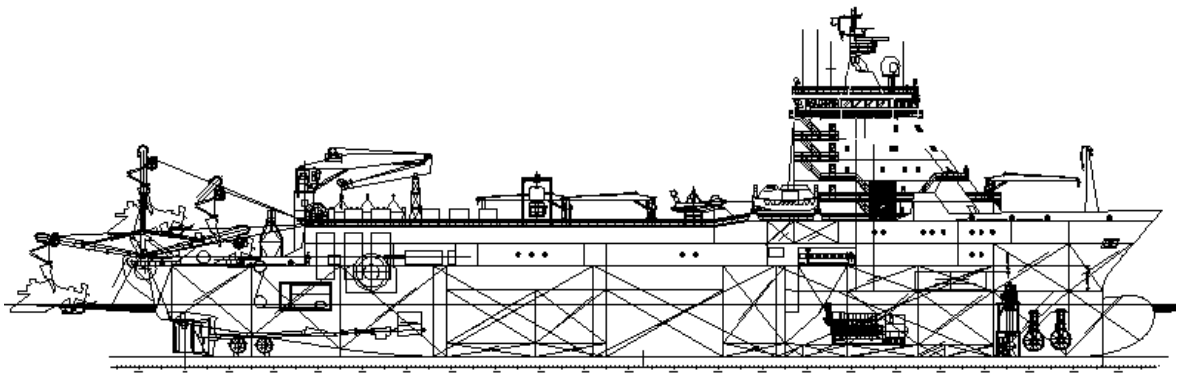


Figure 3-15: Schematic layout of a typical cable-lay vessel

Source: ASN 2021

[1] The actual installation may be subject to last-minute changes of resources, final permit requirements and changes of the lay sequence.

Figure 3-16: Image of a typical cable-lay vessel
Source: ASN 2021

Key components of the design and operation of the cable-lay vessels include:

- **Navigation and positioning technology:** All vessels will use dual high-accuracy GPS navigation. This positioning accuracy will depend on the accuracy of the GPS system; latitude; and satellite visibility over the horizon, mountains and other objects that may restrict or limit GPS signals, but is typically accurate up to 10 m (often less) at any time. Vessels also use a dynamic positioning (DP) system, which is a computer-controlled system that will engage the vessels propellers and thrusters to keep the vessel on a specific point or course.
- **Ballast water management**: Ballast waters will be managed in accordance with the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (BWM Convention) (IMO 2017).
- **Pollution prevention**: The cable-lay vessels will comply with the International Convention for the Prevention of Pollution from Ships (MARPOL)—specifically Annex I, which covers prevention of pollution by oil and oily water; Annex IV, which covers prevention of pollution by sewage; and Annex V, which sets out regulations for the prevention of pollution by garbage.

The vessel does not require the use of anchors to assist in any of the cable installation operations.

3.3.3.2 Pre-Installation Works

Pre-installation works will be undertaken to ensure that the route is clear for cable installation where burial is planned (*i.e.*, at depths shallower than 1,000 m) and across sediments suitable for burial. Pre-installation activities are typically undertaken by the cable-lay vessel or a vessel with similar specifications.

Route Clearance

Route clearance operations will be conducted prior to the laying and burial operations along those sections of the route where burial is to be performed to ensure that, as far as practically possible, the burial operation will not be interrupted.

Route clearance will be performed at specific locations, in areas with planned burial where old out-of-service (OOS) cables are known to cross the cable route. The vessel will remove a suitable section of this old cable to ensure safe ploughing.

The cable ends of any cut OOS cables will be laid onto the seabed and weighted, in accordance with International Cable Protection Committee (ICPC) recommendations.

Pre-Lay Grapnel Run

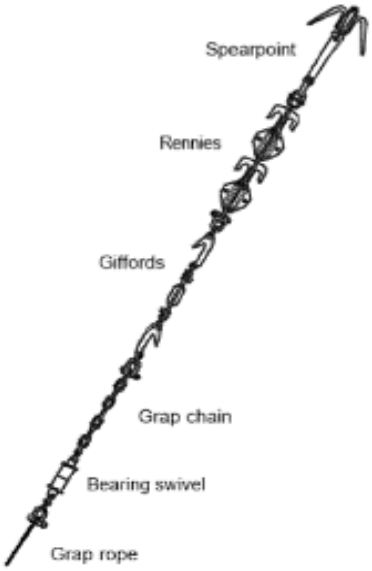
Pre-lay grapnel run (PLGR) applies to areas in which burial is planned; that is, along the route at depths less than 1,000 m and across sediments suitable for burial. PLGR is not conducted over rocky or hard surfaces.

The aim of the PLGR is to remove all debris on the seabed surface (*e.g.*, old fishing nets, ropes and wires, or anchor chains) that may obstruct the ploughing process. Seabed debris can damage the cable and burial equipment. PLGR operations are performed ahead of the burial installation by vessels of opportunity specifically fitted with winches and grapnels, or by the cable-lay vessel itself. Navigation and positioning systems to the same specification used for cable installation will be used to ensure that the route followed for PLGR is as close as possible to the planned cable route.

The vessel will move along the route, towing a grapnel or an array of grapnels (Figure 3-17) along the seabed. Typically, the route is run once, except in areas of high fishing or marine activity, where additional runs might be made. The grapnel penetrates 0.5 to 1.0 m into soft sediment. The PLGR vessel will operate as close to shore as possible. Divers may be used to remove debris near shore or adjust the cable route if debris cannot be removed.

Any debris recovered during these operations will be discharged ashore on completion of the operations and disposed of in accordance with section 10 of the amended EMCA Act, 2015 (NEMA 2015).

The PLGR operation is typically performed to industry standards, employing towed grapnels; the type of grapnel used will be determined according to the nature of the seabed.



Example of Debris

Figure 3-17: Typical PLGR rigging – schematic and image

Source: ASN 2021

3.3.3.3 Cable Lay

The main lay of the cable includes three different installation phases:

- Ploughing in water depths from approximately 15 m to 1,000 m
- Shallow-water surface lay where burial is not possible, or the water is too shallow
- Deep-sea surface lay in water depths greater than 1,000 m

The installation speed (Table 3-2) will largely depend on where the vessel is relative to the seabed topography, and on prevailing weather conditions.

Table 3-2: Operational speed during different installation phases and depths

Installation Phase	Water Depth (m)	Average Operational Speed
Plough Burial	0 to 1,000	0.3 knot (14.4 km per day)
Surface Lay	15 to 1,000	2 knots (90 km per day)
Surface Lay	>1,000	4 knots (170 km per day)

Notes:
km = kilometre
m = metre

Cable Burial

In water depths of up to 1,000 m, the cable is usually buried in soft-bottom areas to protect it from threats such as anchoring, trawl fishing and other maritime activities. This also helps to avoid interference for other sea-users and marine life. Where conditions allow, the cable system has a target burial depth of 2.0 m below the sea floor, from the LWM up to the 1,000 m contour.

The marine survey results indicate that plough burial will generally be feasible and therefore attempted from water depths of around 170 m (for the Mombasa North [Shanzu Beach] branch) and 280 m (for the Mombasa South [Nyali Beach] Branch) to the 1,000 m contour, with two short sections of surface lay. Figure 3-18 shows the planned burial and surface-laid sections of the cable route in Kenyan territorial waters.

Plough Burial

In soft-bottom areas, the cable-lay vessel would install and bury the cable simultaneously using a sea plough (Figure 3-19). The plough can operate in water depths of 20 to 1,500 m. The plough is deployed from the cable-lay vessel and towed along the seafloor (Figure 3-20). The cable is fed through the plough into a narrow furrow at the bottom of a share blade, which places the cable into the seafloor substrate. The sediments displaced during cable burial typically settle immediately back to the seafloor and refill the furrow to bury the cable. The target burial depth is 2.0 m, where seabed sediments and slopes allow. The final depth of the cable will be determined by the hardness or softness of the sediment on the seafloor.

The footprint of the submarine cable plough is limited to where the four plough skids are in contact with seabed surface and the ploughshare, which is approximately 0.2 m wide. The seabed will be left nearly undisturbed after ploughing. Track marks from skids and the ploughshare will remain visible just after installation, but only temporarily; they will disappear over time due to seabed currents and wave action. Ploughing is a well proven industry standard cable burial process which will keep the environmental impact to a minimum, temporally and spatially.

Inshore Burial

The near-shore operation includes the diving team and small workboats required to support the cable-landing operation, cable sinking and positioning on seabed out to around 15 m water depth. A typical diving team includes two small local work boats, one diving supervisor and a diving team of three to six divers. All work will normally be done in daylight hours only, and the safe launch and recovery of a diver takes into consideration a number of factors: wave height, swell, tide/current and wind speed and direction. As a general rule, wave height is limited to 1 m and tidal current is 0.8 knots maximum. The dive team will assist with burial activities, where required. Depending on the onsite conditions, the team will use hand-held or diver-guided equipment such as hand-held water jets, airlift burial tools or burial sledges.

Figure 3-18: Planned burial and surface-laid sections of the cable route in Kenyan EEZ

Figure 3-19: A sea plough ready to be deployed from a cable ship

Source: ASN (Project Joshua) 2020

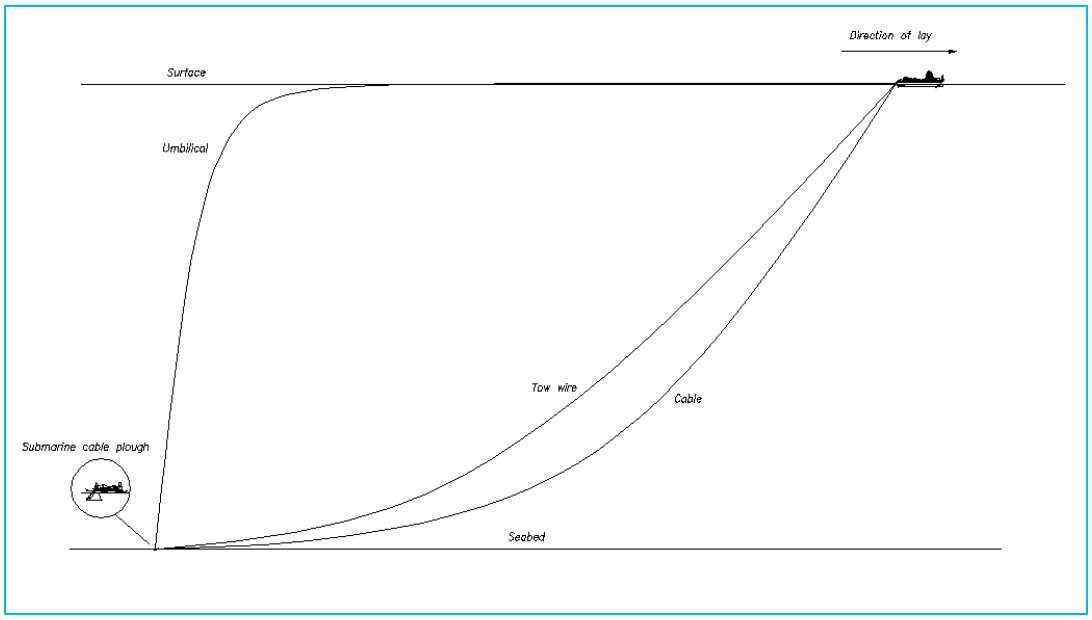


Figure 3-20: Diagrammatic representation of the cable ship and plough

Source: ASN 2020

Cable Surface Lay

The cable will be 'surface laid' in water depths greater than 1,000 m and in hard-bottom areas where burial cannot be achieved. While surface-laying cable, the vessel typically operates at an average speed of 2 to 4 knots (90 to 170 km per day), subject to the topography of the seabed, weather and current.

Deep Sea Surface Lay

The surface lay is guided by an on-board computer system that accounts for depth, bathymetry and other seabed features, as well as external factors such as wind and currents, and is monitored in real time (Figure 3-21). This system reduces the likelihood of unwanted cable suspensions, manages slack and supports accurate placement of the cable along the planned route. Once in place, the cable maintains its position on the seabed due to its weight and tension.

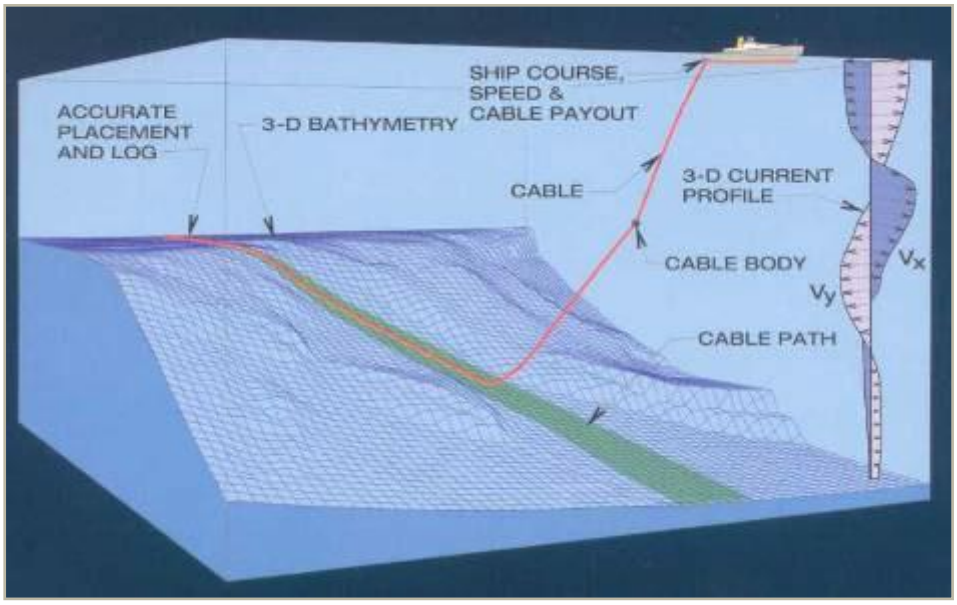


Figure 3-21: 3D Illustration of cable deployment

Source: ASN 2020

Near-Shore Surface Lay

More precise surface lay may be required in shallow water (within safe air-diving range) in connection with cable-landing operations (*e.g.*, to avoid known objects or sensitive habitats close to the agreed cable route). In high-energy environments, as determined by the marine survey or as required to avoid impacts, the cable will be secured to the seabed with clamps and/or protected with articulated pipe (see Section 3.3.2.3). Divers can normally support this activity out to around 25 m of water depth. The Kenya landings will involve two pre-laid shore-ends (one per landing), with the support of small workboats and divers. This process is described in detail in Section 3.3.3.4.

Cable Crossings

Crossings of other subsea telecommunication cables in water depths of more than 1,000 m or in planned non-buried areas will be surface laid over the third-party cable system. The cable owners have been contacted by the 2Africa Project to acquire crossing agreements in accordance with industry practices. No further actions will be required.

Ploughing will not be performed within a specified distance of in-service cables or pipelines. Generally, this distance is 500 m, but can be reduced to 250 m for in-service cables that have been positively identified during survey operations. The proposed cable will be surface laid over the third-party cable.

After installation, crossings in planned burial areas will be subject to post-lay inspection and burial (PLIB) where burial is possible (Section 3.3.3.4).

All crossings will follow the ICPC guidelines, and the crossing angle should normally be as perpendicular as possible. There are in-service cables identified in both the Mombasa South (Nyali Beach) and Mombasa North (Shanzu Beach) routes.

Post-Lay Inspection

Post-lay inspection may be carried out to validate plough burial data where and if required. Visual inspection will be subject to visibility of the water at the time of inspection. Otherwise 'inspection' will be based on cable tracking sensors and forward-facing sonar. Post-lay burial operations will be performed in planned plough-buried areas at:

- shore ends around the point of plough launch/recovery;
- initial, intermediate and final splices;
- crossings of in-service power and telecommunications cables and pipelines;
- branching units;
- unplanned plough skips; and
- areas where seabed slopes are not suited for ploughing and jetting burial is possible.

Post-lay burial in water depths greater than 15 to 20 m will be carried out by jetting, using a remotely operated vehicle (ROV). This ROV 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. In shallow waters, PLIB may be carried out by divers.

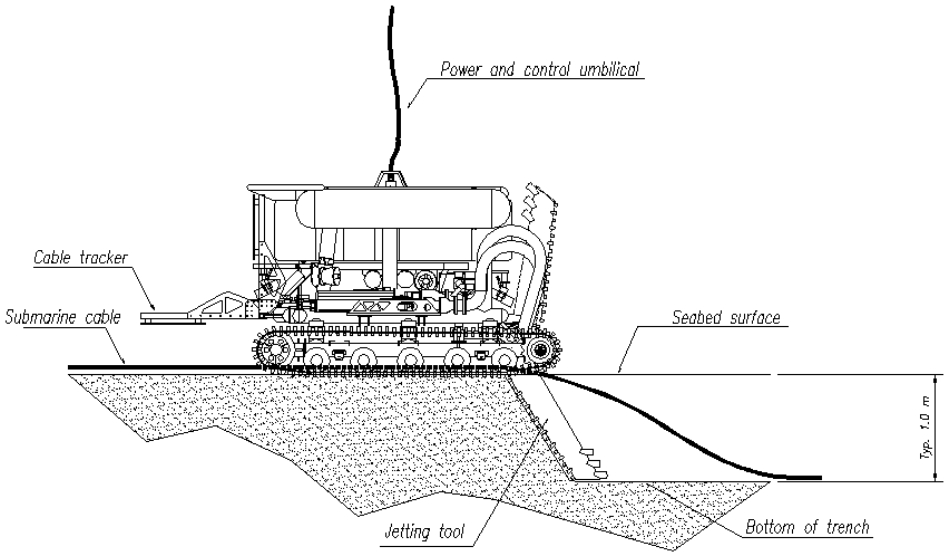


Figure 3-22: Post-lay inspection and burial schematic

Source: ASN 2020

3.3.3.4 Cable Landing

Pre-Laid Shore End Landing

The planned installation method for both cable landings in Kenya is a pre-laid shore end (PLSE). Under this method, the cable will be installed from the beach to water depths of approximately 15 m, where the cable end will be secured to the seabed and later connected to the remainder of the cable branch by the main lay vessel. A PLSE is used when the distance to the 15 m water depth contour is too far from the beach to allow a safe cable installation by the main cable ship. A shallow draft vessel will be used to install the cable in water depths less than 15 m.

The cable-landing operation will typically be completed within a normal working day, starting at first daylight, typically around 6 a.m. local time.

Figure 3-23: Example of a shore-end landing in which the cable is floated before being lowered to the seabed

As part of the PLSE installation, the following activities will take place on the beach:

- Excavators will prepare the beach. They will be set up in beach pulling mode, with one excavator positioned near the landing point, with a quadrant and another excavator prepared with necessary rigging and pulling rope.
- Site safety/security guards may be used in some areas to restrict public access during these operations. Such measures may also be used for safeguarding the equipment and materials on site during these operations.
- If necessary, a full diver swim survey along the planned cable route would be completed no more than a few days before the landing, so that any debris can be removed or be avoided before sinking the cable into its final position.
- For the cable landing on to the beach, a floating hauling line will be run from beach to the shore-end vessel to haul the cable ashore. The shallow draft vessel will simultaneously pay out the cable, allowing it to be pulled ashore. As the cable is paid out from the shore end vessel, floats will be attached (usually every 3 to 5 m).
- Hauling operations will continue until sufficient cable is ashore to reach the BMH and all the remaining shore-end cable onboard the vessel is paid overboard. The final pulling from the shore will straighten the cable out.
- Once the cable end is secured ashore, electrical insulation and fibre tests will be performed. As soon as the tests are completed, divers will be instructed to start to sink and position the cable to the seabed. The floats will be cut away progressively from the shoreline towards the shore-end vessel. Before cutting each float, the divers will position the cable manually or with the assistance of a small boat, so it falls into its desired target location.
- The divers will confirm that the cable is lying flat on the seabed in an acceptable manner and position; where possible, they may manually reposition the cable, if required.
- A diving team and small work boats will support the cable landing and shore-end operation, cable sinking and securing on the seabed; this may include post-burial activities, as required. All work will normally be done in daylight hours only and will be subject to tide, wind, current and waves. A typical diving team includes two small local work boats, one diving supervisor and a diving team of three to six divers.

- The dive team will assist with burial actives, where required and depending on the onsite conditions, using hand-held or diver-guided equipment such as hand-held water jets, airlift burial tools or burial sledges.
- After the cable is placed on the seabed, the cable end, currently on the beach, will be installed in the BMH (see Section 3.3.3.4).
- All floats will be returned by small work boats to the shore-end vessel.
- Divers may adjust cable as required on the seabed to minimise suspensions where needed; for example, if the seabed has boulders, corals or hard ground areas.
- Articulated pipe will then be installed (see 'Protection Measures for the Cable,' Section 3.3.2.3), and the cable will be buried on the beach and inshore as required.

Beach Burials

The beach burial extends from the water line on the day of installation to the BMH or end of seaward ducts. The submarine cable will normally be buried to a depth of 2 m below surface or to hard ground, whichever comes first. This may also include installation and burial of the earth plate and earth cable. Normally, excavators are used for this activity, and the beach is often restored within a few days. A 2 m-deep trench needs to be approximately 6 m wide to safely reach this depth, depending on the sediment properties.

Beach Manhole

The BMH is the transition between the submarine cable and the land cable. The beach joint will be made here. The BMH will be installed within 200 m from the waterline, with a straight line of sight to the landing point at the sea. Once installed, only the manhole cover will be visible.

The BMH has ducts through which the cable will be pulled, where it will then join with the terrestrial portion of the cable system (which is not part of the current scope). Sometimes the seaward ducts may extend several metres to the landing point at the beach. A typical BMH design and size is provided in Figure 3-24. The top hatch should be flush with ground level. Images of a BMH installation and the post-installation conditions are shown in Figure 3-25.

Earth Plates

Submarine cable systems that are optically amplified (using repeaters) need power from the shore to operate the underwater plant. This power is supplied by power feed equipment (PFE) in the CLS at each end of the system.

Each suite of power feed equipment requires a dedicated earth, separate from the terrestrial cable landing station earth, for normal operation. This dedicated system earth is also known as the 'system ground' or 'ocean ground bed.'

The preferred location for the earth plate is near to the cable-landing point at the beach. This allows the transmission cable and the earth return cable to be installed in parallel, in the same conduit system, giving greater resistance to external electrical disturbances.

Earth Plate

An earth plate must be installed a minimum of 25 m from the submarine cable and any other steel objects. The earth plate is 25 mm-thick steel plate, 2 m in diameter, with a weight of approximately 800 kg, including earth cable connection (Figure 3-26). The earth plate must be installed in saturated soil (Figure 3-27).

The proposed locations for the earth plates at Mombasa North (Shanzu Beach) and Mombasa South (Nyali Beach) are shown in Chapter 3, in Figure 3-3 and Figure 3-5, respectively.

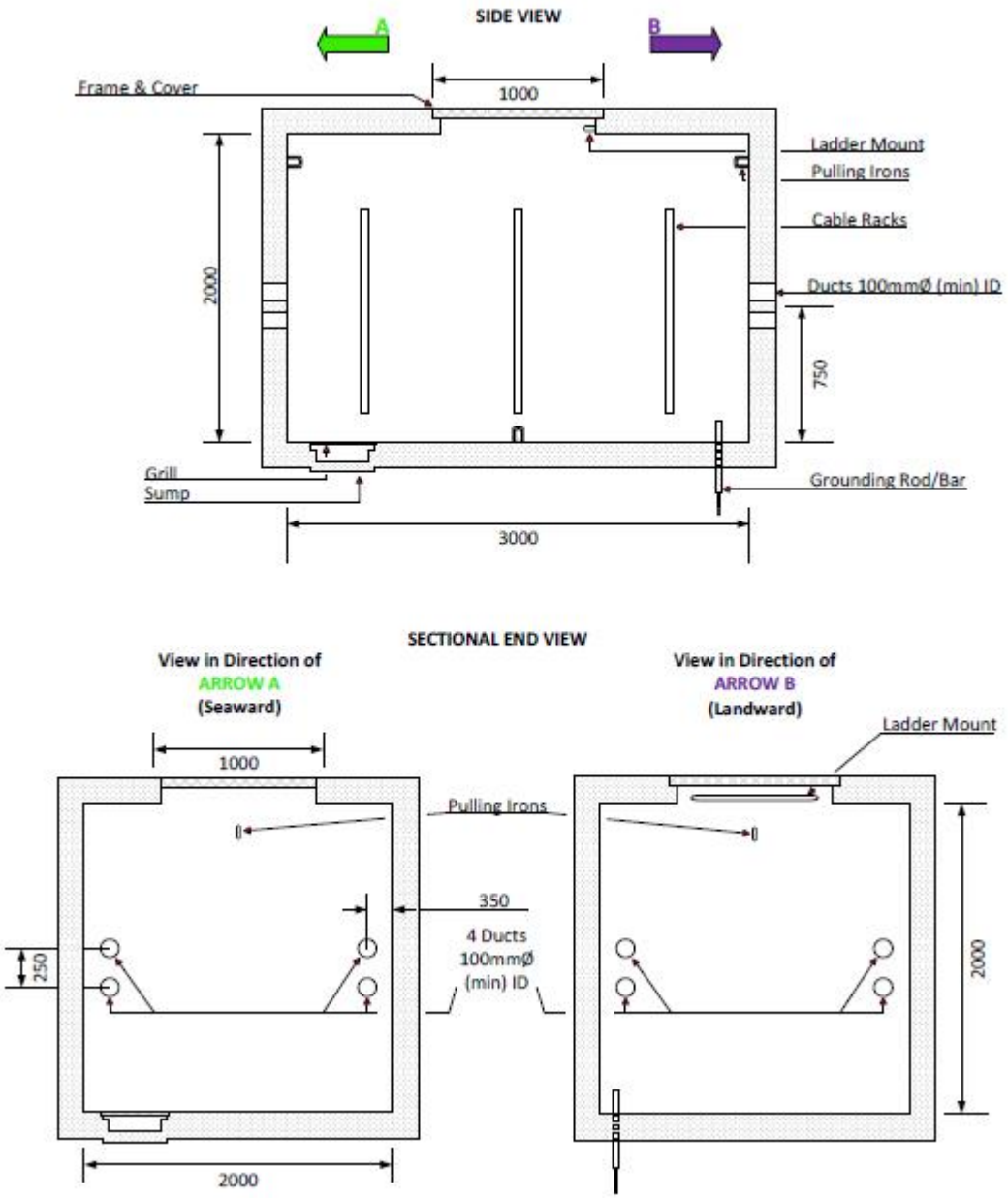


Figure 3-24: Typical BMH design – schematic

Source: ASN 2021

Figure 3-25: Example of a BMH being installed (left) and post-installation image with only the manhole cover visible (right)

Source: ASN 2021

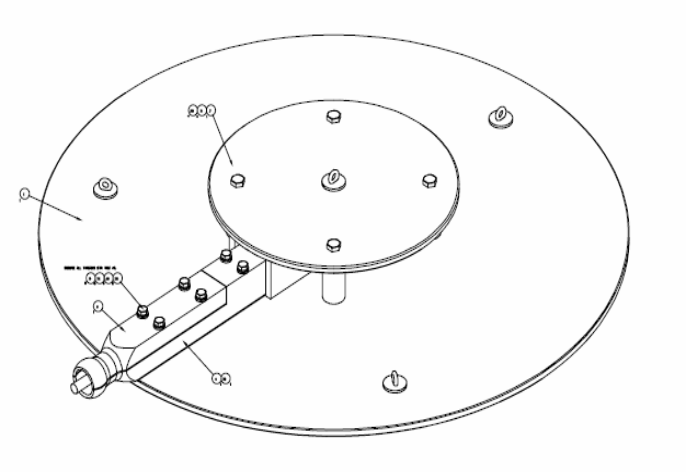


Figure 3-26: Schematic of an earth plate

Source: ASN 2021

Figure 3-27: Example of earth plate installation on the beach

Source: ASN 2021

3.3.4 Schedule and Duration of Work

Table 3-3 and Table 3-4 describe the expected durations of the major Project activities in Kenya. The final installation timing and schedule will depend on receipt of permits and the cable installation programme for the larger cable system, as well as weather conditions and availability of resources.

Table 3-3: Provisional cable installation schedule, by activity

Activity	Location	Estimated Duration
Pre-lay grapnel run	EEZ	10 days
	Territorial Sea	7 day
Pre-landing video	Territorial Sea	4 days
Marine cable lay	EEZ	9.5 days
	Territorial Sea	3 days
PLSE	Shanzu and Nyali Beaches	7 to 10 days each
Marine cable landings	Shanzu and Nyali Beaches	1 day per landing site
Install Articulated Pipe	Territorial Sea	8 days
PLIB	Through Territorial Sea and EEZ	7 days per landing

Notes:
EEZ = Exclusive Economic Zone
PLIB = post-lay inspection and burial
PLSE = pre-laid shore end

Table 3-4: Provisional terrestrial construction schedule, by activity

Activity	Location	Estimated Duration
BMH installation	Shanzu and Nyali Beaches	3 days per landing site
Earth plate installation	Shanzu and Nyali Beaches	1 day per landing site

Note:
BMH = beach manhole

3.3.5 Cable Operation, Maintenance and Repair

During the cable-laying processes described above, extensive GPS data will be collected to record the exact location of installation, referred to as the 'as-laid' position. This information will then be distributed, in standard-format cable record, to relevant parties such as cable maintenance ships, government agencies and other data users. These records will be maintained throughout the system's life and after the system is retired.

- **Operation:** Once installed, submarine cables do not require routine maintenance or inspection. The system can be monitored remotely for faults.
- **Repair**: Cables may not require repair at all during their operational lifetime. They are, however, installed in a way that enables repairs to be carried out if necessary. Cable repair involves locating the cable section that has shown a fault, using a grapnel to bring the cable up to the vessel for repair and returning it to the seafloor afterwards. Depending on the location of the repair, the cable may be reburied.

3.3.6 Cable Decommissioning

There is no definitive position on decommissioning of telecommunication submarine cables. The United Nations Environment Programme document (Carter *et al.*, 2009) points out that the removal of submarine telecommunication cables should be evaluated on a case-by-case basis because the procedures for withdrawal and some local conditions (soil type, crossing with other cables, etc.) can often have a greater environmental impact than leaving the cable on the seabed because the cable can become a habitat for sessile species. In some cases, cables that have a depleted business life may

serve research and teaching purposes. This, in other words, is an extension of their 'useful life,' with the cables now under the responsibility of another owner or manager.

The system has a life span about 25 years; however, a cable system can operate long after this period, and its deactivation can only be performed by the shutdown of the electrical/electronic system and disabling the transmission of information. At the end of cable operation, options for abandoning in place or removing all or portions of the cable will be reviewed in consideration of local requirements at that time.

3.3.7 Best Management Practices

The Project has been designed and planned to achieve the installation with minimal disturbance to coastal and marine resources and users. Mitigation measures have been developed to avoid or reduce impacts during installation of the cable.

Best management practices and industry standards fundamental to the design, installation and operation of submarine cable systems are summarised in Table 3-5.

Table 3-5: Best management practices incorporated into the Project

Project Element	Best Management Practices
Route Planning	• Conduct desktop studies and cable route surveys to assess site-specific conditions and areas to avoid, including sensitive biological and cultural resources, where feasible • Adhere to industry standards, including the ICPC guidelines for routing • Maximise use of existing infrastructure corridors
Main Lay Operations	• Use MakaiLay software, which uses bathymetry, cable and body properties, ship navigation and payout measurements, and even real-time currents to calculate accurate 3D dynamic shapes of the cable to lay flush with the seabed • Observe Maritime law and practices related to ship movements • Use safe operating procedures • Use trained crews and operators • Use navigational equipment, procedures and communications with other marine users, including but not limited to communications with local authorities • Adhere to vessel pollution prevention (refuse and oil/chemical releases) required by international and local laws (MARPOL) • Comply with the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention), and the control and management of ships' biofouling to minimise the transfer of invasive aquatic species (2011 IMO Biofouling Guidelines, 2011) • Bury cable where feasible in water depths shallower than 1,000 m, to avoid conflicts with other marine users and marine species
Shore-end Landing	• Use trained crews and divers • Use divers to lay cable on the seabed within diveable depths, including near sensitive habitats (*e.g.*, coral or seagrass) • Secure cable/articulated pipe to the sea floor in high-energy zones with clamps or other measures to avoid movement or contact with sensitive resources • Maintain detailed procedures, plan of work and daily reports documenting activity • Adhere to site safety and spill prevention plans • Ensure planned and frequent communication between ship and shore crews • Establish and enforce safe distances from equipment, and designated work areas • Engage in advance communication with appropriate agencies, local authorities and community groups • Maintain site access control • Maintain clean work areas and remove Project-related refuse at the end of each day • Restore work areas to pre-installation conditions

Notes:

BWM = ballast water management
ICPC = International Cable Protection Committee
IMO = International Maritime Organization
m = metres
MARPOL = International Convention for the Prevention of Pollution from Ships

Notifications

Relevant authorities and sea-users will be notified prior to installation of the cable in the EEZ and territorial sea, as required and agreed on and according to normal industry practice. This will typically include notification of the nearby local beach/landowners, local police (via the Deputy County Commissioner's offices), Port Captain, and Naval and Coast Guard units.

The cable installer will provide one month's notice to authorities in advance of the start of work for the PLSE. Subject to permitting requirements, the vessel's marine agent may also notify local organised fishing communities and unions in the days preceding the start of operations, so that fishermen have adequate opportunity to remove any fishing gear from the cable route during the brief period of installation, thereby preventing any inadvertent damage to their gear.

Operational messages (such as Navtex) will be issued from the vessel daily and as required, informing and warning local commercial vessel traffic.

In areas with significant local inshore vessel traffic, additional small guard vessels or work boats may be considered to avoid any possible damage to the floating cable during landing operation.

4. Project Alternatives

The identification and analysis of Project alternatives is a requirement of the EIA process, as outlined in Regulation 16 (b) of Environmental (Impacts Assessment and Audit) Regulations, 2003. The exercise aims to improve the Project design, construction and operation decisions, based on feasible Project alternatives. The alternative should be selected based on which has the fewest negative impacts, and on a cost-benefit analysis.

'Alternatives,' in relation to a proposed activity, refers to different means of meeting the general purpose and requirements of the activity, which may include alternatives to:

a) the property on which or the location where it is proposed to undertake the activity;
b) the type of activity to be undertaken;
c) the design or layout of the activity;
d) the technology to be used in the activity;
e) the operational aspects of the activity; and
f) the option of not implementing the activity.

The preferred route for the branch cables and the preferred landing sites that are presented in this EIA were selected after an extensive process that included consideration of alternative options in earlier phases of this Project. For this reason, alternative options a) through e) (*e.g.*, alternative routes, landing sites or cable technologies) are not presented here as Project options, having already been eliminated because they were not feasible or reasonable. For more information on how alternatives were considered and eliminated, please refer to Table 4-1.

Therefore, the only alternative to that described in this EIA would be f), the option of not implementing the activity, or the 'no project' alternative.

Table 4-1: Alternatives considered

Alternative Option	Approach and Reason for Elimination
a) Property or location	The route of the branch cable has been determined through an extensive alternatives analysis process, including investigations of different approaches to the landing sites by the marine survey specialists. The preferred branch cable routes were selected based on the seafloor survey results (avoidance of sensitive environments and habitats, hard substrates and existing services) and on the feasibility of the connection between the trunk cable and the landing sites. Therefore, no feasible or reasonable branch cable route alternatives are presented in this EIA. The cable-landing sites and BMH locations are interconnected with the cable route planning process as well as land ownership and acquisition considerations. The BMHs for both landing sites were initially located directly on the beach and closer to the high-water mark. The local authorities advised against having permanent structures on the beach. Therefore, the proponent has moved the proposed BMHs further inland, away from the beach. The Mombasa South (Nyali Beach) BMH has been moved approximately 27 m from its previous location, and the Mombasa North (Shanzu Beach) BMH has been moved approximately 18 m from its original location. The current proposed landing sites and BMHs are readily accessible and available, and no additional land will be needed. Therefore, the use of alternate sites was dropped from further evaluation.
b) Type of activity	N/A. This is not a privately-owned development site where alternative activities might be considered.
c) Design/layout	See a) above.
d) Technology	The proponent is in the business of telecommunications, and through an extensive prefeasibility process has identified the need for a subsea fibre-optic cable to service Africa and the Middle East. The specific choice of cable technology has been selected to meet the expected capacity requirements and is not considered further here.
e) Operational aspects	N/A. The operational phase of the Project will not offer any alternatives to the proposed operation and maintenance of the subsea cables and BMHs.
f) No Project Alternative	Under a ‘No Project’ alternative, the installation of the fibre-optic cable would not take place. This would mean that the anticipated negative impacts resulting from the proposed commissioning, installation and operation would not occur. Similarly, the positive sociocultural/economic impacts that would also have been anticipated—an increased broadband, internet connectivity and telecommunications capacity for Kenya—would also not occur. The demand for internet connection is rising in the country as a result of e-commerce and the digital education programmes. Improved telecommunications options are in line with Kenya’s Vision 2030 and the Big4 Agenda.

Notes:

BMH = beach manhole
EIA = Environmental Impact Assessment
m = metre
N/A = not applicable

5. Policy, Legal and Institutional Framework

This chapter of the report provides a more detailed overview of the mandatory EIA process to apply for an Environmental License. It also describes the pertinent local and national regulations, standards and policies governing environmental quality, health and safety, and protection of sensitive ecosystems that may be applicable to the Project, and that may require additional permitting processes. This chapter also provides a section on the international agreements and Multilateral Environment Agreements on similar topics to which Kenya adheres.

5.1 Environmental License

5.1.1 Environmental Management and Coordination Act

EMCA is the framework law on environmental management and conservation in Kenya, providing environmental protection through EIAs; environmental audits and monitoring; and environmental restoration orders, conservation orders and easements.

5.1.1.1 Environmental Authority

Part III – Administration, Section 7 of EMCA established NEMA as the government agency responsible for supervising and coordinating all matters related to the environment, in the country, including environmental conservation and management. As the Environmental Authority, NEMA is mandated under EMCA to administer EIAs.

5.1.1.2 Coastal Zone Protection

EMCA defines a '*coastal zone'* as *'the geomorphological area where the land interacts with the sea comprising terrestrial and marine areas made up of biotic and abiotic components or systems coexisting and interacting with each other and with socio-economic activities.'*

Under EMCA, 'land' has the same meaning as in the Constitution of Kenya 2010, which includes the EEZ.

Part V – Protection and Conservation of the Environment, Section 55 of EMCA addresses the protection of the coastal zone with regulations that provide for the control and prevention of pollution in the marine environment arising from or in connection with seabed activities:

> *'55(6) The Minister shall, in consultation with the relevant lead agencies, issue appropriate regulations to prevent, reduce and control pollution or other form of environmental damage in the coastal zone.*
>
> *55(7) Notwithstanding the generality of subsection (6) of this section, the regulations made thereunder shall provide for the control and prevention of pollution –*
>
> *a. of the marine environment from land-based sources including rivers, estuaries, pipelines and outfall structures;*
> *b. from vessels, aircrafts and other engines used in the coastal zone;*
> *c. from installations and devices used in the exploration or exploitation of the natural resources of the seabed and subsoil of the exclusive economic zone; and*
> *d. of the marine environment arising from or in connection with seabed activities and from artificial islands installations and other structures in the exclusive economic zone…'*

5.1.1.3 Environmental Impact Assessment

Under EMCA, an EIA (*'a systematic examination conducted to determine whether an activity or project will have adverse impacts on the environment'*) is required for any project that is likely to have a negative effect on the environment.

a) A proponent or investor shall not implement a project likely to have a negative environmental impact, or for which an EIA is required by the EMCA or regulations issued under it, unless an EIA has been concluded and approved in accordance with the law.

b) No licensing authority under any law in force in Kenya shall issue a trading, commercial or development permit or license for any project for which an EIA is required or for a project/activity likely to have a cumulative significant negative environmental impact unless the applicant produces an EIA licence issued by the Authority.

Part VI – Integrated EIA, Sections 58 through 64 make provisions for carrying out an EIA, notably:

'58(1) Notwithstanding any approval, permit or licence granted under this Act or any other law in force in Kenya, any person, being a proponent of a project, shall, before financing, commencing, proceeding with, carried out, executing or conducting or causing to be financed, commenced, proceeded with, carried out, executed or conducted by another person any undertaking ***specified in the Second Schedule to this Act****, submit a project report to the Authority, in the prescribed form, giving the prescribed information and which shall be accompanied by the prescribed fee.*

58(2)The proponent of any project ***specified in the Second Schedule*** *shall undertake a full environmental impact assessment study and submit an environmental impact assessment study report to the Authority prior to being issued with any licence by the Authority: provided that the Authority may direct that the proponent forego the submission of the environmental impact assessment study report in certain cases.*

58(3) The environmental impact assessment study report prepared under this subsection shall be submitted to the Authority in the prescribed form, giving the prescribed information and shall be accompanied by the prescribed fee…. and,

58(7) Environmental impact assessment shall be conducted in accordance with the environmental impact assessment regulations, guidelines and procedures issued under this Act.'

5.1.1.4 Second Schedule

The Second Schedule to EMCA provided a list of projects requiring submission of an EIA report. A Special Issue, Gazette Supplement No. 62, Legal Notice No. 31 (Legislative Supplement No. 16) was released on 30 April 2019, titled 'Amendment of the Second Schedule of the Act.' This amendment provides three categories of projects according to the perceived seriousness of their likely impacts: Low-Risk, Medium-Risk and High-Risk projects.

Telecommunications infrastructure is listed as a Medium-Risk Project under No. 2(13) '*Telecommunications infrastructures*' under the Second Schedule. For both Low- and Medium-Risk projects, the proponent is required to submit a summary project report to NEMA. NEMA is to screen the report for completeness and, based on their findings, can:

a. exempt the project from submitting a Comprehensive Project Report if NEMA judges it is not likely to generate adverse impacts;

b. recommend that the proponent prepare a comprehensive project report where NEMA judges the project is likely to generate significant adverse impacts.

Applicability of EIA process: The categorisation of the Project as requiring a full EIA was confirmed by Mr. Joseph Makau, a NEMA representative in the Nairobi Headquarters office, on 26 June 2020.

5.1.2 The Environmental Regulations

The Environmental (Impact Assessment and Audit) Regulations, 2003, published in Legal Notice No. 101, pursuant to EMCA, reiterates in Part I – Preliminary, Section 4: Approval of EIA, that a project that is likely to have a negative impact on the environment is to be the subject of an EIA, and is required to have an Environmental License before it can be implemented:

'4. (1) No proponent shall implement a project -

a. likely to have a negative environmental impact; or

b. for which an environmental impact assessment is required under the Act or these Regulations;

unless an environmental impact assessment has been concluded and approved in accordance with these Regulations…'.

Part III – The EIA Study, Sections 16 through 23 describe the mandatory EIA process to be followed, including the TOR for EIA; the EIA Study; the public participation process and lead agency comment process to be followed; the contents of the EIA Report; and the submission to and decision of the Authority. Parts 24 through 28 pertain to the amendment of the license, transfer or surrender of the licence, or cancellation of the licence.

The procedures related to EIA in Kenya are illustrated in Figure 5-1, which shows the steps of an EIA process, as well as the opportunities for community participation.

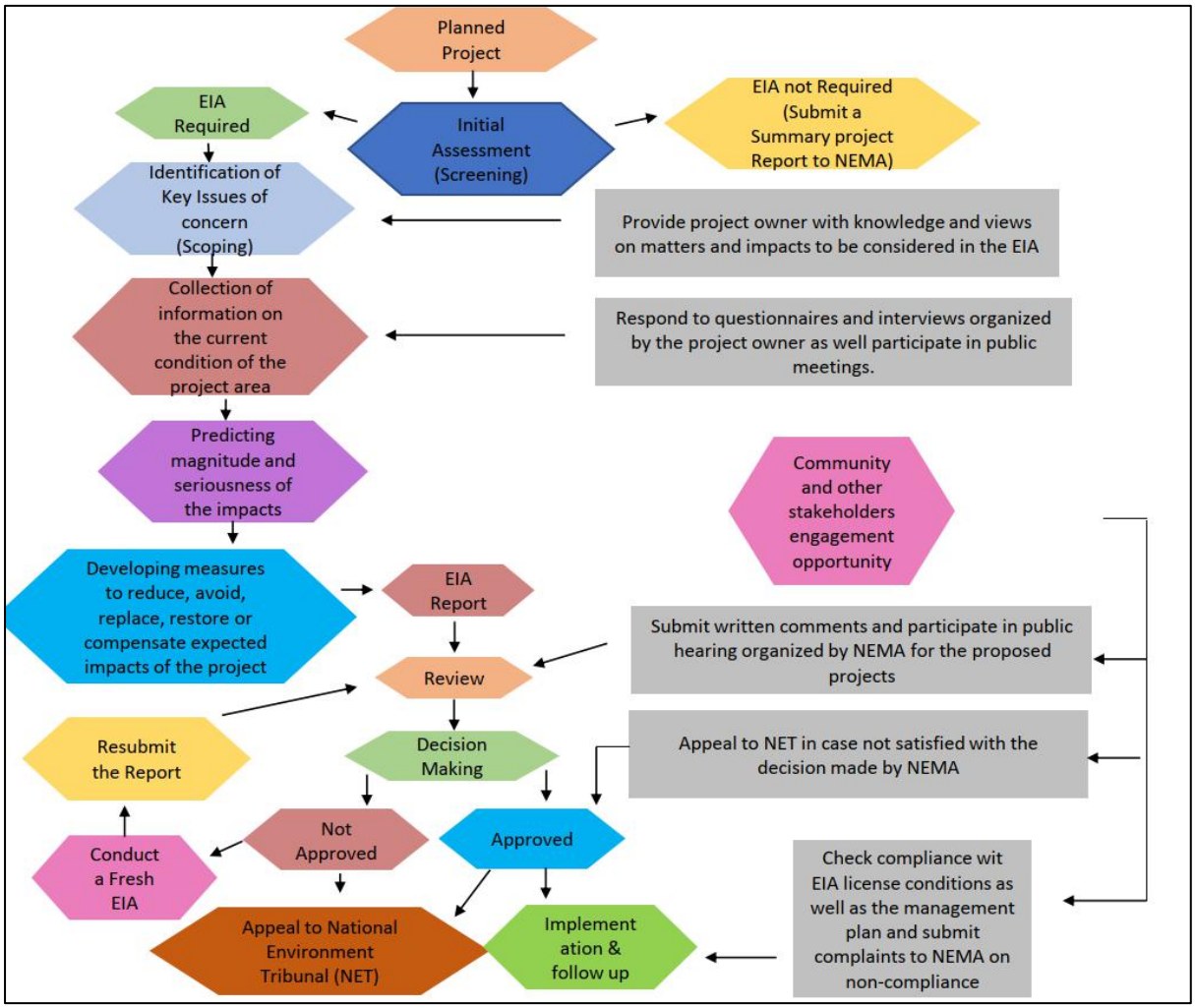


Figure 5-1: NEMA EIA process flow chart

Source: 2020 Transparency International Kenya

5.2 Other Permits Pertaining to the Project

There are a number of other laws, policies and regulations in Kenya that are relevant to the environment and may be relevant to the Project, and for which permits may be required (refer to Table 5-1).

Table 5-1: Kenyan laws and policies applicable to the environment and their relevance to the 2Africa Project

Ref No.	Legal Framework	Description/Relevance	Permit Requirement	Responsibility/ Status
1.	The Constitution of Kenya 2010	Article 42 of the Constitution provides that every citizen has a right to a clean and healthy environment. The legal rationale of public participation in an EIA comes from the Constitution, where it states that every Kenyan citizen has the right to have the environment protected for the benefit of the present and future generations. Articles 10 and 69, respectively, recognise public participation as a principle of governance and give the state a responsibility to encourage public participation in the management, protection and conservation of the environment (GOK 2010).	N/A	N/A
2a.	Kenya Information and Communication Act, 1998	The Act provides the framework for regulating the communications sector in Kenya. Part 3, Section 24, Subsection 1 states that no person shall operate a telecommunication system or provide telecommunication services except in accordance with a valid licence, as stated in the act. The Act established the Communication Authority of Kenya, which has the purpose of licencing and regulating postal, information and communication services in accordance with the provisions of the Act. A submarine telecommunication license is to be obtained from this Authority for this Project by the landing provider.	1. Submarine cable telecommunications license	Landing Provider – pending approval
2b.	National ICT Policy, 2019	This policy is designed to realise the potential of the digital economy by creating an enabling environment for all citizens and stakeholders. The ICT Policy defines the forward-looking position of the Government on various areas of the evolving ICT sector landscape in Kenya.	2. International Gateway License	Landing Provider – pending approval
3.	The Lands Act, 2012	The Kenyan constitution gives the National Lands Commission the responsibility of managing public lands on behalf of the National and County governments. In this Act, 'land' refers to seabed and subsoil of the EEZ. Section 10 of this Act states, 'no person shall carry out development in an interim planning area except with the consent of the authority under these regulations…'. Consent from the physical planning office is to be obtained by the Developer prior to landing the cable. To facilitate preparation of leases on public land, the commission is to request three copies of seabed cadastral maps in form LA 12, set out in the National Lands Commission Regulations scheme. The lease documents and cadastral maps then will be forwarded to the Chief Land Registrar for registration and issuance of certificate of lease. Articles 5 and 7 of UNCLOS give the coastal nations exploitation rights over their EEZs. Such rights include the right of installations and structures, such as submarine cables and pipelines (UNCLOS 1982). A seabed lease, in line with the Lands Act and the provisions of UNCLOS, is to be obtained. The Land Act, however, defers powers for allocation of private land that is in a sensitive environment to other Ministries that have justification over the proposed land use activities. In this case, because the seabed and beach are considered sensitive, the Communications Authority of Kenya is the key ministry/authority to approve the use of the seabed. Based on this approval, the Lands Commission would then able to add its consent for the use/occupation of the seabed and beach.	1. Consent to develop in an interim planning area 2. Seabed Lease	Developer – pending application

Ref No.	Legal Framework	Description/Relevance	Permit Requirement	Responsibility/ Status
4.	The Physical and Land Use Planning Act	Part IV of the act states that a person shall not carry out development in a county without obtaining a development permit, granted by the relevant County Executive Committee Member through the County Director of Physical and Land Use Planning (GOK 2019). Details for application are provided in the fifth schedule of the Act. Before constructing the BMH, a development permit will be required. Section 36 of the Act requires the developer to carry out an EIA for any project that is deemed to have an impact on the environment.	Development Permit	Developer – pending application
5.	EMCA (Wetlands, Riverbanks, Lakes and Sea Shore Management) Regulations, 2009	These Regulations made under the amended EMCA, 2015, make provision for the management, conservation and sustainable use of wetlands and wetland resources and the sustainable use and conservation of (resources on) riverbanks, lake shores and the seashore. The Regulations, among other things, set out general conservation and management principles; and define the duties of the Standards and Enforcement Review Committee and County Environment Committees in respect to wetlands, shores and banks. The Proponent shall comply with the provisions of the Act in protecting the shoreline, and preventing and controlling pollution in the Indian Ocean and on the shore.	N/A	N/A
6.	Wildlife Conservation and Management Regulations, 2016	Section 11 states that any person who intends to undertake any activity in a marine protected or conservation area must submit to the Service for approval, not less than 90 days before the start of the proposed activity, a plan that indicates the specific areas in which the activity is proposed (KWS 2016). The Maputo South and North landing sites are in the Mombasa MNP and the Mombasa MNR, respectively, both of which are Protected Areas. Guidelines from KWS will also need to be followed. A Marine Permit is therefore required from KWS. Section 8, Subsection 3 (Marine Protected and Marine Conservation Areas) states that no vessel propelled by means of propeller is allowed above the waters of an MPA (KWS 2016).	Marine Permit	AECOM on behalf of the Developer – in process
7.	Kenya Maritime Act, 2006 (as amended 2012)	The Kenya Maritime Authority is a statutory authority, established under the Kenya Maritime Act of 2006, with a mandate to regulate, coordinate, and oversee Maritime affairs in the Republic of Kenya (GOK 2012). A vessel registration permit from the Kenya Maritime Authority may be required in terms of the Act, which states that no vessels can sail in Kenyan waters without registration. This will have to be confirmed.	Vessel Registration Permit	Developer – pending requirement
8.	OSHA	The Occupational Safety and Health Act of 2007 defines a workplace as any land, vessel or thing at, in, on or near where a worker will be in the course of employment. The Act applies to all workplaces where any person is at work, whether temporary or permanently. The purpose of the Act is to secure the safety, health and welfare of persons at work. The operators of the vessel are registered with, and activities comply with, OSHA.	1. Workplace Registration Certificate 2. H&S Plan	Vessel Operators – in process
9.	The National Museums and Heritage Act	The Act provides for the establishment, control management and development of national museums, and the identification, protection, conservation and transmission of cultural and natural heritage of Kenya. Part iv, section 30 states that where a person discovers an object of archaeological interest, the person shall, within 7 days, deliver it to the National Museums of Kenya to keep it. If the proponent identifies any archaeological object within Kenyan territorial waters, the object will be delivered to the National Museums of Kenya.	N/A – a shipwreck was identified (age unknown), but the cable route was realigned with a suitable buffer to avoid this potential heritage resource – see Section 7.1.1 of this report.	N/A

Ref No.	Legal Framework	Description/Relevance	Permit Requirement	Responsibility/ Status
10.	Waste Management Regulations, 2006	This legislation provides guidelines for handling different kinds of waste. It states that no person shall dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle. The Developer is to ensure that all waste is segregated before being transported to a designated waste treatment facility by a contracted, NEMA-licensed waste transporter.	Waste disposal certificates	Contractors – pending installation phase
11.	Access to information Act, 2016	The main objectives of this Act are to give effect to the right of access to information by citizens, as provided under Article 35 of the Constitution; provide a framework to facilitate access to information held by private bodies in compliance with any right protected by the Constitution and any other law; promote routine and systematic information disclosure by public entities and private bodies on constitutional principles relating to accountability, transparency and public participation and access to information; and provide a framework to facilitate public education on the right to access information under this Act. A Stakeholder engagement process was undertaken, more information can be obtained in Chapter 6.	N/A	N/A
12.	EMCA (Noise and Vibration pollution) Regulations, 2009	The Regulations elevate the standard of living of the people by prescribing acceptable noise levels and regulating excessive vibration from a facility or activity. The regulations prescribe the maximum permissible noise levels from a facility or activity to which a person may be exposed to; provide for the control of noise; and provide for mitigation measures for the reduction of noise. The Project is within acceptable noise and vibration levels.	N/A	N/A
13.	EMCA, 1999	EMCA, 1999, Is the framework law on environmental management and conservation. Part IV under Section 58 of the Act directs that any proponent for any project listed on the Second Schedule of the act undertake and submit to NEMA an EIA; NEMA in turn my issue a license as appropriate.	Environmental License	AECOM on behalf of the Developer – in process

Notes:

BMH = beach manhole
EIA = Environmental Impact Assessment
EEZ = Exclusive Economic Zone
EMCA = Environmental Management and Coordination Act
H&S = health and safety
ICT = Information, Communications and Technology
KWS = Kenya Wildlife Service
MNP = Marine National Park
MNR = Marine National Reserve
MPA = Marine Protected Area
N/A = not applicable
NEMA = National Environment Management Authority
OSHA = Occupational Safety and Health Act
UNCLOS = United Nations Convention on the Law of the Sea

5.2.1 Institutional Mandates

Table 5-2 outlines the relevant bodies and institutions involved in the application of the various permits required as part of the Project.

Table 5-2: Institutional mandates

Institution	Stakeholder/Licenses/Permit Approval
National Environment Management Authority	EIA License
Communication Authority of Kenya	Submarine Cable Landing International Gateway
Ministry of ICT	Key stakeholder
Kenya Wildlife Service	Permit to work in a Marine Protected Area
National Lands Commission	Approval of constructing the BMH and laying the submarine cable on the seabed
Public works	Public works consent
Kenya Maritime Authority	Compliance certificate
Directorate of Occupational Safety and Health Services	Workplace certificate
Kenya Ports Authority	Stakeholder
Coast Development Authority	Stakeholder
Kenya Marine and Fisheries Institute	Stakeholder
Kenya Coast Guard	Stakeholder
Mombasa County Government	Oversight and Coordination

Notes:

BMH = beach manhole
EIA = Environmental Impact Assessment
ICT = Information, Communications and Technology

5.3 International Legal Framework

International Framework is used as a broad guideline to help integrate environmental concerns on an International platform. Table 5-3 outlines the international legislation that is applicable for the 2Africa Project landing sites in Mombasa.

Table 5-3: International legislation

Ref No.	Policy/Convention	Relevance
1.	Nairobi Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Western Indian Ocean	The Convention provides a legal framework through which contracting parties address critical national and trans-boundary issues, share experiences, and create opportunities for sustained socioeconomic growth. The convention aims to tackle the accelerating degradation of the world's oceans and coastal areas through the sustainable management and use of the marine and coastal environment. It does this by engaging countries that share the western Indian Ocean in actions to protect their shared marine environment.
2.	United Nations Convention on the Law of the Sea III (UNCLOS III) 1982	UNCLOS recognises unique freedoms for installation and maintenance of subsea cables. Subsea cables are permitted freedoms and protections accorded to no other marine activity. Article 79 of this law states that all states are entitled to lay submarine cables and pipelines on the continental shelf.
3.	Convention on Biological Diversity	The Convention has three main objectives: the conservation of biological diversity; the sustainable use of the components of biological diversity; and the fair and equitable sharing of the benefits arising out of the use of genetic resources. Kenya's national goals under the convention are to: • ensure and maintain a high-quality environment that permits a life of dignity and well-being for all; • achieve sustainable use of resource ecosystem for the benefit of the present generations, while ensuring their potential to meet the demands of future generations; • maintain ecosystems and ecological processes essential for the functioning of the biosphere; and • preserve genetic resources and biological diversity in the nation's ecosystems and preserve their cultural value.
4.	Ramsar Convention	The mission of the Convention is the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world. Kenya has six Ramsar sites, Tana River Delta being the only one on coastal Kenya. This location is not near the proposed Project site.
5.	MARPOL	MARPOL is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. There are six annexes in the regulations: • Annex 1 provides the regulations for the prevention of pollution by oil. • Annex 2 regulates pollution by noxious liquid substances. • Annex 3 prevents pollution by harmful substances carried by sea in packaged form. • Annex 4 prevents pollution by sewage from ships. • Annex 5 prevents pollution by garbage by ships. • Annex 6 prevents air pollution from ships. The proponent will liaise with Kenya Maritimes Authority in accordance with MARPOL.
6.	Indian Ocean MOU	The Indian Ocean MOU on Port State Control recognises the need for increased maritime safety and the protections of marine environment, and the importance of improving living conditions on board. The Port State Control aims to verify whether foreign flag vessels calling at a port in a state comply with maritime conventions. When vessels are found to be not in substantial compliance, the Port State Control system imposes actions to ensure that the vessels comply. Ships to be inspected are selected according to the criteria outlined in the MOU (IMO 2021).

Notes:

MARPOL = International Convention for the Prevention of Pollution from Ships
MOU = Memorandum of Understanding
UNCLOS = United Nations Convention on the Law of the Sea

6. Public Consultation

This chapter provides a summary of actions undertaken during the stakeholder engagements. The engagement was undertaken in line with the national legal requirements, the Constitution of Kenya (2010) and the Amended EMCA Act, 2015. The Constitution recognises public participation as an integral requirement in all policy and statutory functions of the executive and legislature, and as an inherent requirement in the planning and execution of projects that have an impact on the social or economic life of communities. The EMCA calls for effective stakeholder participation and public consultation in the EIA process. The full summary of output from the public stakeholder engagements is included in Appendix F.

6.1 Objectives of Public Consultation and Participation

Stakeholder consultations were carried out pursuant to compliance with the legal and regulatory requirements cited above. The specific objectives of the consultations were to:

- inform the public and the key informants regarding the proposed Project, and its anticipated benefits and effects;
- provide an opportunity for interested parties to share their views, concerns and recommendations for incorporation into the Project implementation designs (*i.e.*, cable route and installation process);
- identify perceived socioeconomic and environmental impacts for the various Project phases and to capture mitigation and enhancement measures from stakeholders;
- build relationships with the local communities and authorities;
- manage expectations;
- ensure compliance with both local regulatory requirements and international best practice; and
- acquire local knowledge on sensitive areas in the proposed BMH area.

The Constitution of Kenya outlines the national values and principles of governance, which include patriotism; democracy and participation of the people; human dignity; equity; social justice; inclusiveness; equality; human rights; non-discrimination and protection of the marginalised; good governance; integrity, transparency and accountability; among others. The following values and principles guided the stakeholder engagement for the Project:

- transparency and honesty in engaging with stakeholders;
- timely access to information and documents relevant to decision making;
- clear communication and adequate time investment to ensure that all affected stakeholder groups understood the issues at hand prior to decision making;
- respect of local culture and related values, with full cognisance of human rights as protected by the Constitution;
- observance of human rights;
- promotion of inclusiveness, including clear mechanisms to empower vulnerable and marginalised groups to promote their active participation, with reasonable measures undertaken to reduce the barriers to participation as experienced by these groups; and
- proactiveness in consulting stakeholders and seeking feedback on issues.

6.2 Stakeholder Identification and Analysis

Stakeholders are people who may be impacted by, or who have an influence on or an interest in the Project. This includes those who would be impacted either positively or negatively by the Project. Different issues and concern were raised by different stakeholders; for this reason, stakeholders have been grouped in accordance with their connections to the Project.

Stakeholder identification and analysis entails determining who the Project stakeholders are; the key groupings and subgroupings of stakeholders; and a more in-depth look at the group's interests, how they will be affected by the Project, and to what degree they are likely to influence the Project. It is important to understand that not all stakeholders will have the same influence or effect on the Project, nor will they all be affected in the same manner.

Overall, the stakeholders were grouped either as:

- **Primary stakeholders:** These are the people who will be affected directly by the Project activities during installation and operation. They include fishermen; tourists; area residents in both Nyali and Shanzu; and local business owners such as hotels along the beach where Project activities will take place.
- **Secondary stakeholders:** These are the people who will be indirectly affected by the Project but influence Project implementation. They include the national government authorities who provide permits, the County Government of Mombasa, and local administration and parastatals.

For this Project, stakeholder identification and analysis were carried out to identify the various groups and stakeholders to be engaged for the Project. A working list of stakeholders is provided in Table 6-1.

Table 6-1: List of stakeholders identified to be part of the consultation process

Stakeholder Category/Group	Stakeholders	Scope of Agency with Reference to the Project
Permitting/Regulatory Authorities		
Communication Authority of Kenya	• Head of permitting and compliance department	Telecom licence
NEMA	• NEMA Officials in Mombasa/Nairobi	Environmental management, policy and licencing
Kenya Wildlife Service	• Head of permitting and compliance department	Permit to work on a Marine Protected Area (potential due to proximity of Mombasa MNP
National Lands Commission	• Head of permitting and compliance department	Seabed Lease Permit
MoD – Coast Guard	• Head of permitting and compliance department	Defence – approval by MoD to enter Kenya's waters
Kenya Maritime Authority	• Head of permitting and compliance department	Vessel permit to sail in Kenya water
Kenya Ports Authority	• Head of permitting and compliance department	Permit to operate in the vicinity of the port entrance
Coast Development Authority	• Compliance Department	Checking on Permitting requirements
Implementing Authorities		
Kenya Forest Service	• Head of Conservancy	In charge of protection of mangroves in the area
County Government		
Department of Lands Mombasa County	• CEC Land, Housing and Physical Planning	Local administration – approval to construct BMH

Stakeholder Category/Group	Stakeholders	Scope of Agency with Reference to the Project
National Government		
Administration	• County/Deputy/Assistant Commissioners • Sub-county administrators • Ward administrators • Chiefs and sub-chiefs	Entry point for engaging with community members
BMU/Community		
BMU Shanzu BMU Nyali Community	• Village heads and elders	Village heads and elders act as the voice of the community and have an influence on community development.
	• BMU members	BMU members derive their various sources of livelihood from the beach and surrounding environment. For such groups, the Project is likely to cause tension in their operations, and engaging them is necessary to demystify any negative perception they may have towards the Project
Non-Governmental Organizations		
CBO, FBOs, NGOs	• Sample of key CBOs and FBOs to be identified	Some NGOs, CBOs and FBOs may have a direct interest in the Project and may be able to draw on its benefits for economic or community development purposes. Such organizations may also have useful data and insight and may be able to become partners to the Project in areas of common interest.
Private Sector		
Hotels, businesses on the beach etc.	• Prime hotels operating in the proposed BMH locations	Pride Inn Paradise Beach Resort, Serena Beach Resort and Spa, and Nyali, Sun Africa Beach Resort Mombasa

Notes:

BMH = beach manhole
BMU = Beach Management Unit
CBO = community-based organisation
CEC = County Executive Committee
FBO = faith-based organisation
MNP = Marine National Park
MoD = Ministry of Defence
NEMA = National Environment Management Authority
NGO = non-governmental organisation

6.3 Approach to Consultations

This section describes the approach used to mobilise and conduct the consultations for the stakeholders identified in Section 6.2 above.

Due to restrictions in response to COVID-19, the Project team prioritised the use of virtual meetings and phone calls to present an overview of the Project and to seek feedback and comments from stakeholders. Where this was not possible, face-to-face meetings were arranged, in line with the Government of Kenya Ministry of Health's guidelines on COVID-19, observing social distancing and limiting the number of attendees.

For this EIA, engagement consisted of two main stages: a first round of stakeholder engagement (informative), and a second round of engagements (consultative).

These activities were carried out by the consultants for the period between October 2020 and November October 2021; further information on each stage is outlined below. All meetings undertaken as part of this EIA study have been documented in the form of meeting minutes, registers and photographs (where possible). These documents are summarized in Appendix F.

6.3.1 Methods of Communication and Engagement

Different platforms were used to engage stakeholders for this Project. The choice of the platform used was determined by efforts to minimise the spread of COVID-19. As outlined above, the consultant team applied the following methods to communicate and engage stakeholders:

- **Emails.** The team arranged the meetings and shared meetings invites and details of the Project with stakeholders via e-mail.
- **Telephone calls.** Where no email address was available, the team used telephone calls to engage stakeholders. One-on-one telephone calls were used to set up meeting appointments.
- **Letters.** In the absence of email addresses and telephone contacts, the team sent letters to stakeholders to seek their views on the Project. Where possible, the letters were stamped by the stakeholder's office to confirm proof of receipt. Additionally, formal letters were used to officially notify some government agencies of the Project.
- **Virtual meetings.** Virtual meetings were set up to present information to stakeholders and to seek their feedback. A combination of Microsoft Teams and Zoom platforms was used, depending on the stakeholder's preference.
- **In-person meetings.** In line with NEMA's COVID-19 stakeholder engagement protocols, two roundtable meetings were arranged with the BMU representatives in Shanzu and Nyali.
- **Comprehensive Questionnaire Surveys.** A baseline survey was circulated at the public meeting to collect opinions and views from individual stakeholders from the community and relevant key informants for purposes of publicising the Project.

6.3.2 Public Notification

In accordance with the EIA Regulations (2003), Part III, section 17, the actions indicated in Table 6-2 were undertaken to inform the public about the proposed Project.

Table 6-2: Actions taken for the public consultation process

Regulation 17 (2)	Actions
17(2)(a)(i) Posting posters in strategic public places in the vicinity of the site of the proposed project informing the affected parties and communities of the proposed project	Project posters were prepared and issued to the Deputy County Commissioner's office in the two proposed BMH site locations on 23 September 2021. The posters were subsequently issued to the respective Chiefs in the Kongowea and Shanzu locations and displayed in public areas 14 days prior to the meeting dates. See Appendix F for a sample poster.
17(2)(a)(ii): Publishing a notice on the proposed project for two successive weeks in a newspaper that has a nation-wide circulation	This notice is to be published in a newspaper (the Daily Nation and the Standard), informing the stakeholders that they have a 30-day period within which NEMA will receive their feedback. The notice shall be gazetted upon NEMA's request once the EIA report is submitted for review.
17(2)(a)(iii): Making an announcement of the notice in both official and local languages in a radio with a nation-wide coverage for at least once a week for two consecutive weeks	Local radio stations that broadcast within the Project zone of influence include: • Radio Rahma (91.5 FM): is a broadcast radio station from Mombasa, Kenya; and • Bahari FM (90.4) is part of the Royal Media Services and transmits in Swahili.
17(2)(b): Hold at least three public meetings with the affected parties and communities to explain the project and its effects ad to receive their oral or written comments	Public meetings were held on 6 and 7 October 2021. The records of these meetings are appended to this report (refer to Appendix F).

Notes:

BMH = beach manhole
EIA = Environmental Impact Assessment
NEMA = National Environment Management Authority

6.3.3 Rounds of Public Consultation

Two rounds of stakeholder engagement took place. The first round was primarily conducted during the reconnaissance visit to Mombasa in October 2020. The stakeholders were identified during preliminary stakeholder mapping and analysis. The team sought the guidance of these stakeholders on the Project's environmental and social sensitivities and permitting requirements, to inform the Project's design and to guide subsequent engagements during the actual EIA study.

The second round introduced the Project to primary and secondary stakeholders. The engagement was accomplished through a combination of virtual meetings and in-person meetings in October and November 2021. Prior to the consultations, the Project team engaged the County Commissioner, Deputy Commissioner and chiefs in Nyali and Kisauni (Shanzu) sub-counties. The aim of these meetings was to introduce the EIA phase of the Project, and to discuss the logistics of the public consultation meetings.

In these two rounds of consultation, the objective was to engage the stakeholders listed in Table 6-1; however, some of the stakeholders who were invited to participate in consultations did not respond to the invitation. A list of these stakeholders and the dates when emails and/or letters were sent can be found in Appendix F.

6.4 Stakeholder Engagement Summary

The following sections summarise the meetings that were held as part of the stakeholder engagement. The meetings adhered to the guidelines for stakeholder engagement activities that were published by the Office of the NEMA Director General during the COVID-19 pandemic.

The public consultation exercise was interactive and yielded positive outcomes. The Consultant adopted a balanced approach by ensuring that those who supported the Project and those who sought more clarification got a chance to participate. For details on the proceedings of the consultative meetings, please refer to the summary in Appendix F.

6.4.1 First Round of Stakeholder Engagement – Informative

In total, 20 meetings were successfully conducted in this round of engagements; the meetings were held between 26 October 2021 and 4 November 2021. Two of these meetings were focus group discussions with Shanzu and Nyali BMUs, respectively. The meeting with the Nyali BMU is pictured in Figure 6-1, and the itinerary for this round of engagements is summarised in Table 6-3.

Figure 6-1: Photograph of meeting with Nyali BMU on 30 October 2020

Table 6-3: List of stakeholders consulted during first round of engagement

Date	Stakeholder	Venue
26/10/2020	Coast Development Authority	Virtual Meeting
27/10/2020	Site Reconnaissance Shanzu	BMU Mombasa North (Shanzu Beach)
	NMK	NMK Mombasa Town Offices
	KWS	KWS Mombasa Town Offices
	County Fisheries Department	County Offices Liwatoni
28/10/2020	CC Mombasa	CC's Office
	National Environment Management Authority Offices Mombasa	KFS Building First Floor, Left Wing
	KFS Mombasa	KFS Building First Floor, Right Wing
	Site Reconnaissance Nyali	BMU Mombasa South (Nyali Beach)
29/10/2020	KCGS	KCGS Offices Liwatoni
	Fisheries	Fisheries Offices Liwatoni
30/10/2020	DCC Kisauni Subcounty	DCC's office Bamburi
	Assistant Chief Shanzu	Chief's Office Shanzu
	Chief Nyali	Chief's Office Bombolulu
	Village Elder Nyali	Beach Road Nyali
	Focus Group Discussion, BMU Shanzu	Shanzu Beach
31/10/2020	BMU Nyali	Early Bird Nyali Beach
4/11/2020	Coastal Oceans Research and Development – Indian Ocean East Africa	Virtual Meeting

Notes:
BMU = Beach Management Unit
CC = County Commissioner
DCC = Deputy County Commissioner
KCGS = Kenya Coast Guard Services
KFS = Kenya Forest Services
KWS = Kenya Wildlife Service
NMK = National Museums of Kenya

The main issues discussed in the consultations related to the impact on sensitive habitats in the area, as well as the safety concerns regarding the installation process. Overall, the stakeholders emphasised the importance of assessing the marine conditions to ensure that the anticipated Project impacts are minimised and mitigated.

6.4.2 Second Round of Stakeholder Engagement – Consultative

In all, 18 meetings, both virtual and in person, were successfully conducted in this round of engagements; the meetings were held between 21 September 2021 and 3 November 2021. Two of these meetings were public meetings with Nyali and Shanzu communities, respectively.

The stakeholders engaged during this stage are listed in Table 6-4.

Table 6-4: List of stakeholders consulted during second round of engagement

Date	Stakeholder	Mode of Engagement
21-Sep-21	State Department of Fisheries, Aquaculture and The Blue Economy	Virtual Meeting
29-Sep-21	KMFRI	Virtual Meeting
30-Sep-21	Kenya Ports Authority	Virtual Meeting
05-Oct-21	Assistant County Commissioner (Nyali)	In person Meeting
05-Oct-21	Deputy County Commissioner Mbuba (Shanzu)	In person Meeting
05-Oct-21	Mombasa Land's Registry	In person Meeting
06-Oct-21	Chief Nyali	In person Meeting
07-Oct-21	Chief Shanzu	In person Meeting
19-Oct-21	KFS	Virtual
29-Oct-21	CA	Virtual
06-Oct-21	Nyali BMU	In person Meeting
06-Oct-21	Nyali BMU Representative	In person Meeting
07-Oct-21	Shanzu BMU	In person Meeting
07-Oct-21	Shanzu BMU Chairperson	In person Meeting
19-Oct-21	KFS	In person Meeting
28-Oct-2021	Mombasa Country Commissioner	Letter
02-Nov-21	KWS	Virtual Meeting
03-Nov-21	Communication Authority of Kenya	Virtual Meeting

Notes:

BMU = Beach Management Unit
KFS = Kenya Forest Services
KMFRI = Kenya Marine and Fisheries Research Institute
KWS = Kenya Wildlife Service

Photographs of the Shanzu public consultation are shown on Figure 6-2.

Figure 6-2: Shanzu public consultation

Figure 6-3 shows photographs of the Nyali public consultation.

Figure 6-3: Nyali public consultation

6.4.3 Summary of Public Meeting Stakeholder Feedback

The main aim of the fora was to provide a platform for stakeholders to share experiences in similar scenarios; give their views on the proposed Project; suggest sustainable approaches; and recommend impact mitigation and enhancement measures for consideration by the Consultant and the Proponent. The participants supported the proposed Project because they perceived it as having more benefits than negative impacts.

Overall, the stakeholders emphasised the importance of assessing the marine conditions to ensure that the anticipated Project impacts are minimised and mitigated. The participants were also interested in understanding the direct benefits of the Project to them and the local community.

Some of the main concerns from the stakeholders included, but were not limited to:

- impacts on fauna and flora during installation/construction activities;
- land restoration after installation;
- existing safety measures relating to community health and safety issues;
- notice periods required for different stakeholders;
- radiation impacts;
- cable security during operation; and
- local labour.

The consultant told the stakeholders that all of their requests will be shared with the Project Proponent for consideration. A full summary is included in Appendix F.

7. Specialist Studies

To understand the environment in which the proposed 2Africa cable will be laid, specialist studies were considered to inform the cable route, to avoid any obstacles that might be of importance and to ensure that appropriate mitigation measures are in place where needed. Table 7-1 indicates which specialist fields were considered and explains why this specialist field was or was not pursued.

Table 7-1: Specialist fields considered for the Project

Item	Specialist Field	Justification
1	Marine Survey	A marine survey was undertaken by Fugro Germany Marine GmbH in 2020/2021.
2	Marine and Coastal Ecological Study	The Marine Impact Assessment was undertaken by WRTI in 2021.
3	Heritage Resources	The marine survey identified a shipwreck in the shallow waters of the original corridor of the Mombasa South (Nyali Beach) branch cable route. The route was subsequently amended to avoid the shipwreck. A suitable buffer was imposed on the shipwreck to ensure that it would remain unaffected by the Project activities. No other heritage resources were identified during the marine survey for either of the branch corridors; therefore, no further heritage assessments were deemed necessary.
4	Terrestrial Ecology	No terrestrial ecology investigation was needed because all terrestrial environments affected by this Project are marine or coastal and therefore covered by the Marine and Coastal Ecological Study.

Note:
WRTI = Wildlife Research and Training Institute, the research division of Kenya Wildlife Service

7.1 Fugro Marine Survey

As part of the cable route planning, ASN commissioned a specialist marine survey company, Fugro Germany Marine GmbH (hereafter referred to as Fugro), to perform a cable route survey. The survey was conducted to provide geophysical and geotechnical information on the nature of the seafloor within a defined corridor of the proposed cable route. Fugro was contracted to survey a safe and economical route for the proposed cable by determining water depth, seabed hazards, geomorphology and other oceanographic and anthropogenic data. Special attention was given to the recording and charting of rock outcrops and other hard substrates, as well as areas of coral, sea grass and other sensitive organisms.

NEMA granted Fugro an Environmental Operating License for the operation of its bathymetric survey of the Ocean Fund along the coast of Kenya on 15 September 2020. Fugro undertook the bathymetric survey and prepared a report for each of the branch cables, 235 km and 240 km in length, respectively, titled:

- 2AFRICA Subsea Cable Network, Volume – Segment E10, BMH Mombasa South – BU MBS, Book 01: 15 March 2021 (Fugro Germany Marine GmbH)
- 2AFRICA Subsea Cable Network, Volume – Segment E11, BMH Mombasa North – BU MBN, Book 01: 19 March 2021 (Fugro Germany Marine GmbH)

Fugro performed the 2Africa deep and shallow water survey operations in the Indian Ocean using the vessel MV Fugro Gauss and a smaller vessel Alumaster on the following dates:

- Mombasa South (Nyali Beach) between 20 December 2020 and 17 January 2021
- Mombasa North (Shanzu Beach) between 26 December 2020 and 17 January 2021

The following surveys were undertaken for both Mombasa South (Nyali Beach) and Mombasa North (Shanzu Beach) branch cables:

1. Onshore Survey (topographic) – ±250 m inland up to the LWM
2. Inshore Survey – between water depths of 3 m to 15 m (500 m corridor width)
3. Offshore Survey – (Shallow Water Survey) between water depths of 15 m and 1,000 m (500 m corridor width)

4. Offshore Survey (Deep Water Survey) – in water more than 1,000 m in depth (=/>1,000 m corridor width)

The objective of the survey was to better understand the geophysical and geotechnical nature of the seafloor; this would help inform the cable route to avoid obstacles that might be of importance, and that could also damage the cable in the longer term. The survey was also used to assess the characteristics of the seafloor sediments and to determine appropriate installation methods.

The findings from this survey have been used to refine the proposed cable route in Kenyan waters. A summary of the methodologies used, as well as 'North-Up' charts" showing the data collected for the South and North Branches, are included in Appendix B of this report. Key findings relevant to this EIA are outlined in the following section.

7.1.1 Findings of Environmental Relevance

The key environmental findings relevant to this EIA are provided in Table 7-2.

Table 7-2: Key environmental findings of the Fugro surveys for the Nacala and Maputo landing sites

Landing Site	Topic	Finding
Mombasa South (Nyali Beach)	Existing Cables	Seven in-service cables, two out-of-service cables and one planned cable were identified in the corridor. No pipelines were identified.
	Coral Areas	The Inshore Survey area is located through Nyali Reef, which is formally protected. The reef is documented to comprise 25% coral and 38% rock.
	Seagrass Areas	Seagrass areas (*Thalassodendron* sp.) were identified during the Inshore Survey – the Nyali Reef offers formal protection to Seagrass habitat.
	Shipwrecks	One shipwreck was found in the corridor during the Shallow Water Survey (see Section 7.1.1.1 below).
	Wildlife	No marine mammal observations were made during the survey.
Mombasa North (Shanzu Beach)	Existing Cables	Six in-service cables, one out-of-service cable and one planned cable were identified in the corridor. No pipelines were found.
	Coral Areas	The Inshore Survey area is located through Shanzu coral gardens, which is formally protected. The reef is documented to comprise 25% coral and 38% rock.
	Seagrass Areas	Floating seagrass and seaweed were observed during the Inshore Survey – no bathyscope inspections were conducted.
	Shipwrecks	None observed.
	Wildlife	None observed.

7.1.1.1 Heritage Resources: Shipwrecks

During the initial review stage of the Project, the National Museums of Kenya (NMK) in Mombasa was identified as a key stakeholder for consultation. On 27 October 2020, a site visit was undertaken with Mr. Phillip Wanyama, an archaeologist based in Mombasa. A brief meeting was also held with the Head of Coastal Archaeology, Mr. Ceasar Bite. The NMK advised that a heritage assessment along the proposed cable route may be required, specifically with regard to shipwrecks.

One of the findings from the shallow water survey was the presence of a shipwreck (age unknown) in the corridor of the shallow waters of the Mombasa South (Nyali Beach) branching cable. It was identified on latitude 4° 4'44.51"S, and longitude 39°43'14.21"E. The route of the cable corridor was adjusted to avoid the shipwreck altogether, and a buffer of 100 m was imposed to protect the shipwreck from Project activities.

Figure 7-1 shows the change in the cable route after the identification of the shipwreck in Mombasa South (Nyali Beach). The blue line represents the revised cable route; the white line represents the original cable route before the marine survey was conducted by Fugro. Because the shipwreck is now 110 m from the cable route, the proposed cable will cause no impacts.

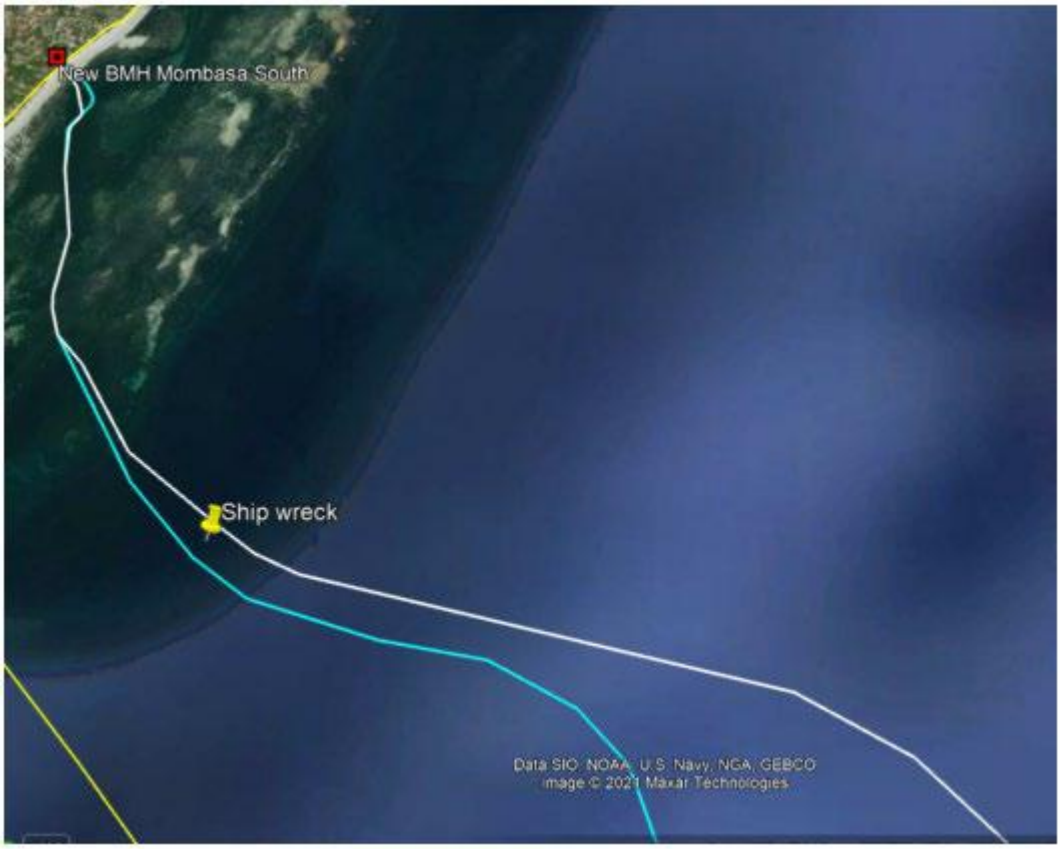


Figure 7-1: Change of cable route in Mombasa South (Nyali Beach) upon identification of a shipwreck

Other than the shipwreck, there were no other objects/obstacles identified along the cable route that may have been considered potential heritage resources. It was therefore concluded that an additional heritage and archaeological survey would not be necessary as part of the EIA study. On 30 September 2021, a letter was sent to NMK describing these findings and the conclusion that no further heritage studies are required in the EIA.

7.1.2 Route Refinements

Detailed charts (called 'North-Up' charts) were developed to guide the proposed cable routing and installation methods (see Appendix B).

Following the Fugro survey of the Mombasa South (Nyali Beach) and Mombasa North (Shanzu Beach) branch cable routes, route development on the original route corridor was undertaken. The following route amendments were made:

- **Mombasa South (Nyali Beach).** Between kilometre point (KP) 4.0 and KP 11.0, the survey route was amended to avoid two features; between KP 50.0 and KP 70.0, the survey route was amended to avoid a large outcrop.
- **Mombasa North (Shanzu Beach).** No amendments were made (two additional route options were considered through the Mombasa MNP; they were surveyed but rejected).

7.2 WRTI Marine and Coastal Ecological Study

The proposed installation of two branch cables for the 2Africa Project will traverse a combined Marine Protected Area (MPA), consisting of the Mombasa MNR and the Mombasa MNP, with the southern branch crossing the Mombasa MNR and the north branch crossing the Mombasa MNR and the Mombasa MNP. These MPAs are within the mandate of Kenya Wildlife Service (KWS) for the conservation of marine biodiversity. Through KWS, the Wildlife Research and Training Institute (WRTI) was subcontracted by AECOM for a marine specialist Ecological Impact Assessment of the 2Africa Project in the MPA. The assessment aimed to document the MPA's existing marine biological environment, which represents an important area for biodiversity.

The overall goal of this assessment was to determine whether the potential impacts of the Project's interaction with the sensitive marine ecosystem are significant, and to recommend avoidance or mitigation measures to prevent a net loss in biodiversity when the Project is implemented. The specific objectives are to:

1. document the marine biodiversity of the area;
2. identify potential impacts of the Project and suggest mitigation measures; and
3. prepare a report to feed into the EIA for the Project and to support issuance of a right-of-way permit for passage through the MPAs.

7.2.1 Methodology

The assessment methodologies take into account the requirements of the Kenyan EMCA, 2015, as well as relevant best international practice, including the following:

- The United Kingdom (UK) Institute of Environmental Management and Assessment – Suite of General and Topic Specific Guidelines for Environmental Impact Assessment (various dates)
- The UK Chartered Institute of Ecology and Environmental Management – Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal (2010)

7.2.1.1 Desktop Research and Expert Interviews

Data and information from recent rapid surveys of the intertidal and subtidal areas were gathered through detailed desktop research of the status of coral reef colonies and sea grasses in the Project AOI. A review was conducted of any existing marine life inventories completed for the area in the last 5 years.

Local experts and scientists with knowledge of the area were also consulted to provide additional insight on the marine biodiversity and habitats in the Project AOI.

7.2.1.2 Site Surveys

Walking transects were undertaken along the cable-landing sites on the beaches at Nyali and Shanzu; biodiversity data and other relevant information were recorded and mapped. Data obtained from routine boat transects undertaken by KWS/WRTI were used to assess the status of fish species in the MPA and the immediate environment.

7.2.2 Findings

The following section provides a high-level overview of the findings from the marine specialist study. Detailed information on the environmental setting and consideration of Project impacts has been incorporated into the corresponding sections of this EIA Report.

7.2.2.1 Southern (Nyali Beach) Cable Segment

Approximately 15 km of the southern branch cable route cross the Mombasa MNR in the approach to the Mombasa South (Nyali Beach) landing. This area is designated as a Mombasa MNR that falls under

category II of the International Union for Conservation of Nature (IUCN) protected area classification. The Mombasa MNR is set aside to protect ecological processes, along with the complement of species and ecosystems characteristic of the area, while allowing for environmentally and culturally compatible public use. Some of the activities taking place in the reserve include fishing, glass-bottom boating, snorkelling and swimming. Table 7-3 outlines the cable installation activity relative to the environmental setting for the Southern (Nyali Beach) cable route.

7.2.2.2 Northern (Shanzu Beach) Cable Segment

Approximately 2.5 km of the northern branch (Shanzu Beach) cable route passes through the Mombasa MNR, with 0.5 km of this distance traversing the Mombasa MNP. The Mombasa MNP falls within category I of the IUCN protected area classification—where the area is set aside to protect biodiversity and also possibly geological/geomorphologic features; and where human visitation, use and impacts are strictly controlled and limited to ensure protection of conservation value. Table 7-4 outlines the cable installation activity relative to the environmental setting for the Northern (Shanzu Beach) cable route.

7.2.3 Conclusion

The northern cable landing at Shanzu Beach was found to be more environmentally sensitive than the offshore environment near the southern cable landing (Nyali Beach). Potential impacts to marine biodiversity associated with the installation and operation of the 2Africa submarine cable system relate to potential damage to sensitive habitat that may be on or near the cable route and that could be impacted by sediment plumes; pollution release and/or shipping accidents; or disruption of recreational and/or tourist and fishing activities during cable installation.

Based on the findings discussed above, the majority of the of these potential impacts can be avoided through appropriate operational procedures or through the use of in-built mitigation measures (*i.e.*, hand-laying cable in a route that bypasses sensitive coral reef communities). Most of the other identified potential impacts related to marine habitats are highly localised, are short-lived and will be minimal after the cable is laid and operational. Therefore, the habitat disturbance caused during the installation and operation of the cable is unlikely to have a net loss effect on biodiversity.

Table 7-3: Environmental setting of the southern (Nyali Beach) cable segment

Section of the Cable	Substrate Characteristics	Environmental Setting	Project Installation Methods
From the BMH to the HWM	This is the terrestrial component and will consist of a stretch of sandy beach of approximately 121 m, from the intertidal zone to the BMH to the HWM.	The cable route does not fall directly within sensitive environments, but sensitive sites were identified in the Project area of influence. The cable-landing site is not very far from turtle nesting sites along Nyali Beach.	The cable will be buried to a depth of 2 m beneath the sand.
From HWM to 1.3 km offshore (15 m deep) (in the Mombasa MNR)	Soft-bottom, sandy substrate that transitions to hard bottom	Sea grass and corals are present.	The cable will be diver-laid and buried in this section where feasible, and routed around corals and boulders. Articulated pipe will be applied for 248 m of the route, adding additional weight that will further prevent cable movement once installed.
From 1.3 km (15 m deep) to 10.6 km (292 m deep) (in the Mombasa MNR)	The seafloor drops off to deeper waters and is characterised by steep slopes, boulders, debris, rocks and depressions.	Some corals and seagrass are present before entering the deep-sea habitat.	The cable will be laid on the surface, meaning that no plough burial plough will be undertaken in this section.
From 10.6 km (292 m deep) to 234.6 km (1,000 m deep) (outside the Mombasa MNR)	In this section, the seafloor substrate is comprised of softer, thicker sediments, with occasional boulders, debris, rocks and depressions encountered along the route.	This section transits into deep sea, where the seafloor flattens out and the marine habitat changes, becoming less sensitive ecologically.	Plough burial is planned for this section of the route, with two small breaks in ploughing of 600 m and 6 km.

Notes:

BMH = beach manhole
HWM = high-water mark
km = kilometre
m = metre
MNR = Marine National Reserve

Table 7-4: Environmental setting for the northern (Shanzu Beach) cable segment

Section of the Cable	Substrate Characteristics	Environmental Setting	Project Installation Methods
From the BMH to the HWM	This is the terrestrial component. It will consist of a stretch of sandy beach from the intertidal zone to the BMH to the HWM.	The cable route does not fall directly within ecologically sensitive areas but is instead situated on a sandy stretch of beach. However, there is the potential for turtle nesting nearby because the cable-landing site is not far from known and recorded turtle nesting sites. Tourism activities are prevalent along the beach, with a number of hotels and boat operators present. Notable beach erosion was recorded as well.	The cable will be buried to a depth of 2 m beneath the sand.
From HWM to 2.4 km offshore (24 m deep) (in the Mombasa MNP and the Mombasa MNR)	Soft-bottom, sandy substrate that transitions to hard bottom	Sea grass and coral habitats present. The cable route in the Mombasa MNR is approximately 2 km long, and the route in the Park is approximately 500 m long.	The cable will be diver-laid and buried in this section, where feasible, and routed around corals and boulders. Articulated pipe will be applied for 248 m of the route, adding additional weight that will further prevent cable movement once installed.
From 2.4 km offshore (24 m deep) to 4.7 km (169 m deep) (outside of the Mombasa MNP and the Mombasa MNR)	The seafloor drops off to deeper waters and is characterised by steep slopes, boulders, debris, rocks and depressions.	A few small coral outcrops are present. This segment is outside the MPA and is of low ecological sensitivity.	This segment of the cable will be laid on the surface, meaning that no plough burial or trenching will be undertaken in this section. The cable will be routed around coral and boulders.
From 4.7 km (169 m deep) to 87.058 km (1,000 m deep) (outside the Mombasa MNP and the Mombasa MNR).	The seafloor flattens out with softer, thicker sediments, with occasional boulders, debris, rocks and depressions along the route. Plough burial is planned for this section of the route.	Deep sea environment outside the Mombasa MPA. This area is not ecologically sensitive and has neither coral gardens nor sea grasses.	Plough burial is planned for this section of the route, with brief breaks in ploughing, typically around cable crossings.

Notes:

BMH = beach manhole
HWM = high-water mark
km = kilometre
m = metre
MNP = Marine National Park
MNR = Marine National Reserve
MPA = Marine Protected Area

8. Baseline Information of the Proposed Project Site

This chapter of the report presents geophysical and hydrographic information about the climatic, geophysical and biological characteristics of the Project area. The baseline information discussed for the Project relates to both the marine and terrestrial component. The WRTI was commissioned to undertake a marine assessment, and that assessment provided some of the baseline information used to inform this chapter.

8.1 Physical Environment

The Kenyan coastline is generally low-lying and characterised by an almost continuous fringing coral reef, extending parallel to the coast and lying a few metres below present sea level. The area's geomorphology consists of sediments from the Tertiary, Cretaceous, Jurassic, Triassic and Precambrian ages (NEMA 2020).

Mombasa County is one of the seven counties in the coastal region, situated in the south-eastern region of Kenya. It lies between latitudes 3°80' and 4°10' south of the equator and longitudes 39°60' and 39°80' east. Mombasa County borders Kilifi County to the northeast, Kwale County to the southwest and the Indian Ocean to the east. The County covers an area of 294.6 square kilometres (km^2), including 65 km^2 of water mass.

8.1.1 Sandy Beaches

Kenya is renowned for its gently sloping to steep beaches, characterised by white calcareous sand of marine origin (coral sand). The sandy beaches are important recreational sites for tourists and a key resource in the development of the tourism sector in the country. Beach tourism in Mombasa County occurs primarily in three popular areas—Nyali, Bamburi and Shanzu—covering some 13.5 km. In the three locations, hotels have been built along the shoreline in response to increased tourist demand; most of these have encroached on the delicate sandy beach ecosystem.

The sandy beach ecosystems are also important habitats for diverse fauna, including sea turtles, birds and marine invertebrates.

Nyali and Shanzu sandy beaches are on latitudes -4.056 and -3.968 and longitudes 39.704 and 39.756, respectively. Beyond the sandy beach is system of rocky shores and hanging cliffs. The beach area lies at an altitude of less than 30 m above sea level and experiences severe erosion at 2.5 to 20 centimetres (cm) per year, which threatens coastal development.

Nyali Beach is characterised by quartzitic terrigenous fine sands of grain sizes of between Φ2.83 and Φ2.63. The grain sizes tend to be coarse during the northeast monsoon season and fine during the southeast monsoon season. Nyali Beach is gently sloped and ranges between 64.4 and 80.2 m in width.

Shanzu Beach is approximately 1.3 km long. The beach consists of moderately well sorted and mesokurtic, medium to fine sand with grain sizes ranging from Φ1.99 to Φ1.84. The beach is characterised by calcareous coarse sand and shell fragments; it has a relatively steep slope of 5.490:4.180 and a narrow width of between 29.51 and 44.41 m (WRTI and KWS 2021).

8.1.2 Climate and Hydrographic Information

The climatic condition variations in the area are attributed to south-easterly monsoon winds that occur between April and September (the rainy season) and the north-easterly monsoon winds that occur between October to March (the dry season). The area receives localised conventional rainfall. The rains occur during the inter-monsoonal period, with the long rains starting in March through July; the short rains occur in October through December. The mean annual rainfall for the short rains is 240 mm and 665 mm for the long rains. Mombasa is generally hot and humid all the year round. The mean daily temperature ranges between 22 and 29.5°C. The lowest temperature is experienced during the long rainy seasons.

Mombasa is characterised by a warmer tropical marine environment, dominated by the northward-flowing East African Coastal Current and reversing winds of the monsoon (WRTI and KWS 2021).

Because Kenya's economy is highly dependent on natural resources, it is highly vulnerable to climate variability and change. Rising temperatures and changing rainfall patterns result in more frequent and intense extreme weather events such as droughts and flooding, threatening the sustainability of the country's development. This impacts ecosystems, water resources, food, health, coastal zones, industrial activity and human settlements (NEMA 2021).

There are seven significant currents that influence climate and weather along the East African coastline: Somali Currents, Equatorial Counter Currents, East Africa Coastal Current, South Equatorial Current, East Madagascar Current, Mozambique Current and Agulhas Current. These currents are indicated on Figure 8-1.

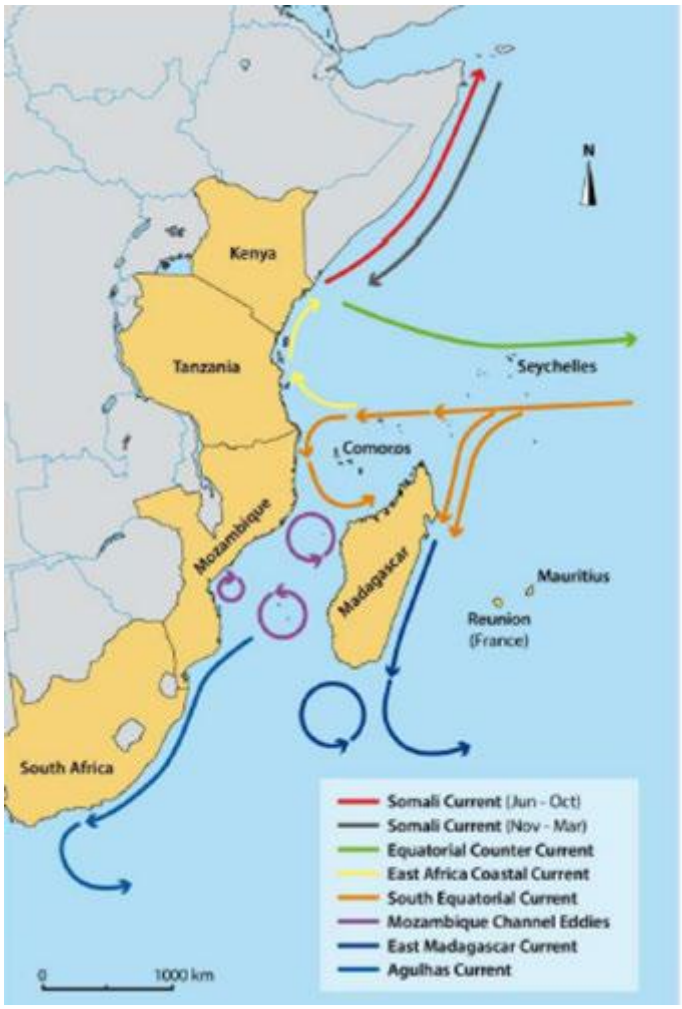


Figure 8-1: Schematic of Indian Ocean currents

Source: Fugro 2020

Sea waves are usually generated by winds and are mostly of moderate height (0.5 to 2.5 m). Tides in the Mombasa seaside area are predominantly semi-diurnal. Tidal levels range from a 4.1 m at the highest to -0.1 m at the lowest (KPA 2020).

The drainage system of Kenya's coast flows in the east-southeast direction to drain into the Indian Ocean. The Tana River rises on the northern slopes of Mount Kenya and flows for around 400 km through the very arid Northern Frontier before entering the Indian Ocean near Kipini. Its flow is dependent on rains in the highlands, but it is a permanent water course and provides water, as well as water for irrigation and for household use. The Galana drains the southern slopes of Mount Kenya. Athi River is the other major drainage of the eastern half, and feeds in the Galana River.

8.1.3 Bathymetry and Topography

8.1.3.1 Bathymetry

Bathymetry is the measurement of the depth of a water body. Water depths along the Mombasa South (Nyali Beach) cable route remain shallow (4 m or less) for the first 2.9 km of the cable route. The shelf then drops to a water depth of approximately 47 m by KP 3.2. The seabed morphology from the shore is generally smooth, and the seabed sediments consist of 0.5 m coarse sediment overlying sub cropping rock with occasional boulders. The characteristics change to a rough seabed with a gentle to moderate gradient in the deep-water depths. Seamounts have been observed in Kenya's deep water at depths ranging from 2,750 to 3,500 m; measuring 800 m, 1,500 m and 2,000 m; and averaging 890 km^2. Although their contribution has not been estimated, seamounts form high-productivity ecosystems by supporting upwelling (GOK 2017).

Water depths along the Mombasa North (Shanzu Beach) cable route range from 0 to 6 m for the first 2.3 km of the cable route, before dropping to 24 m at KP 2.65. The seabed initially has a gentle gradient with a surface that is rough due to the presence of numerous irregularly shaped depressions; it changes to a rough seabed with a moderate gradient.

8.1.3.2 Topography

The Kenyan coast is divided into four major geological physiographic zones (NEMA 2020): the coastal plain, the foot plateau, the coastal range and Nyika.

The area is a coastal plain, with extensive flat areas rising gently from 8 m to 100 m above sea level in the west. Nearer the sea, the land consists of coral reef of Pleistocene Age that offers excellent drainage. The coral limestone and lagoon deposit reach a thickness of 100 m. Along the coastline are beaches that, together with a variety of coastal resources and a rich biodiversity, have made Mombasa a popular tourist destination.

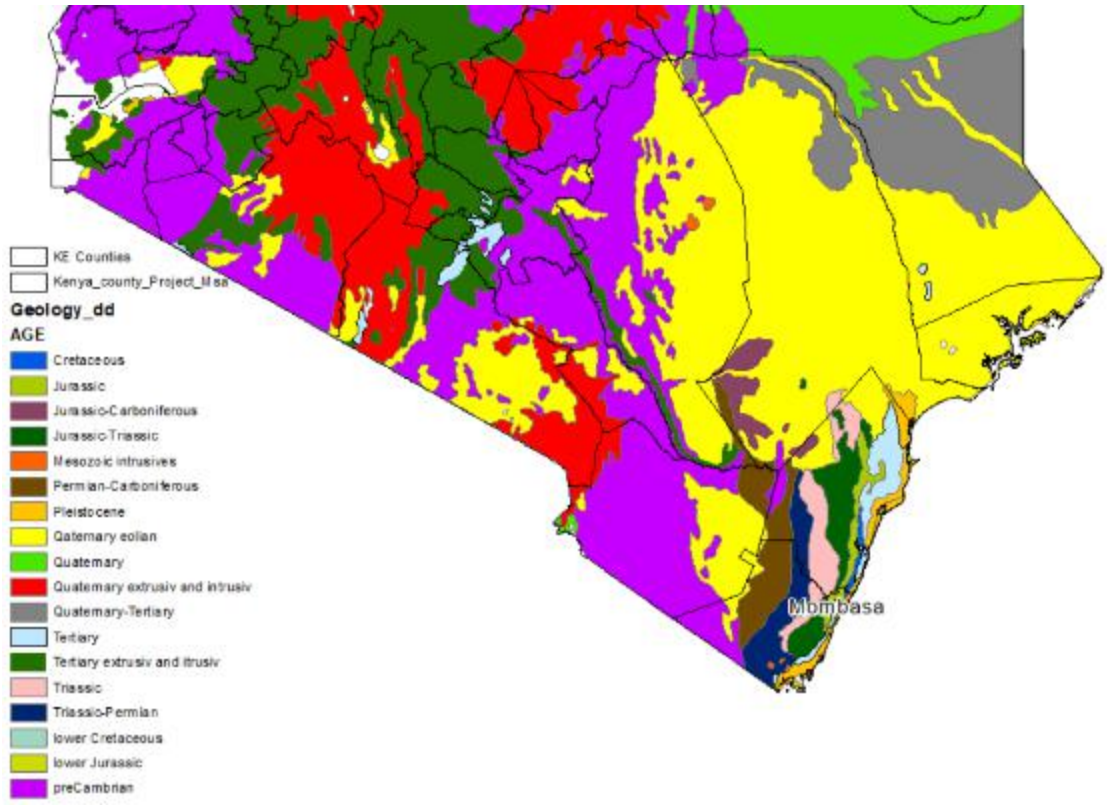


Figure 8-2: Geology of the southern regions of Kenya

Source: Kenya Data

8.1.4 Geology, Geomorphology and Marine Sediment

8.1.4.1 Nearshore Environment

The nearshore environment in the vicinity of the Mombasa North (Shanzu Beach) and Mombasa South (Nyali Beach) landings comprises a mix of course and fine sediments, subcropping rocks, and coral reefs.

8.1.4.2 Terrestrial Environment

The geology of the Kenyan coast is composed of sediments from the Tertiary, Cretaceous, Jurassic, Triassic and Precambrian ages. Much of Kenya is covered by Precambiran Basement (Mozambique system), Tertiary volcanoes and Quaternary sediments. It also consists of coastal terrigenous clastic sediments of the Karoo system belonging to the Jurassic (144-206 Ma) and Tertiary (1.8-6 Ma) periods (NEMA 2017).

The Kenya coastal region is generally low-lying and characterised by an extensive fossil reef, which lies a few metres above present sea level. The coastal environment is set in a passive continental margin (*i.e.*, tectonically inactive), the evolution of which was initiated by the breakup of the mega continent Gondwanaland in the Lower Mesozoic.

The Kenyan coast can be described in three geological physiographic zones. The Nyika lies at 600 m above the present sea level and represents the higher ground covered by the Duruma sandstone series and older rocks to the west. The Foot Plateau lies at an elevation between 140 and 600 m above the present sea level. The coastal plain is dominated by a series of raised old sea-level terraces.

Sediment lithology of the Kenyan coast shows a combination of alluvium and terrigenous to aeolian (windblown) sediments. The coastline is dominated by coral reef, with instances of pronounced aeolian sediment.

The characteristics of Mombasa area is categorised as follows.

- The Coastal Plain between Kisauni on the northern mainland and Mtongwe on the southern mainland, including Mombasa Island, is a coastal terrace consisting of elevated coral reef.
- The western area of Mombasa consists of a rock layer of ground shale and sand. This area is composed of materials from the tertiary system and the Mesozoic system.
- The mountainous plateau is made of sandstone.

The city of Mombasa is centred on Mombasa Island, but extends to the mainland. The island is separated from the mainland by two creeks: Port Reitz in the south and Tudor Creek in the north. Mtwapa Creek is found to the north of Mombasa County and marks a separation with Kilif County.

8.1.5 Water Quality

The condition of coastal water is an important indicator of environmental quality, particularly pollution load and related issues. In Kenya, sewage disposal, oil pollution and dredge spoil dumping have been reported as the major human disturbances responsible for the declining water quality along the coast of Mombasa MNP and the reserve in Nyali-Bamburi-Shanzu Lagoon. A KWS investigation concluded that the water exchange between the Nyali-Bamburi-Shanzu lagoon and the Indian Ocean results in relatively clean water that efficiently removes any land-based pollutants. However, there was evidence of contamination of lagoon water by surface runoff, groundwater and occasional direct discharge of raw sewage, as evidenced by occasional high spikes of nutrients and faecal bacteria (KWS 2001). The Nyali coral garden is highly affected by land-use activities, such as effluents from groundwater seepages on the beach and water of poor quality that flows outward from the Tudor mangrove creek. (WRTI and KWS 2021).

8.1.6 Air Quality

In Kenya, air pollution is a leading cause of respiratory diseases such as chronic obstructive pulmonary disease, lung cancer, pulmonary heart disease and bronchitis. The effects of outdoor air pollution are compounded by those of indoor air pollution. Most households use charcoal and firewood for domestic cooking.

According to the United Nations Environment Programme Air Quality Catalogue, air quality challenges in Kenya include the following:

- Traffic emissions have been identified as the leading cause of air pollution in major cities in Kenya.
- Traffic-related emissions are exacerbated by the importation of second-hand vehicles.
- Poor solid waste management is also an important source of air pollution.
- The majority of households use kerosene and biomass-based fuel (charcoal) for domestic cooking, leading to substantial indoor exposure to air pollution (NEMA 2019).

Sources of air pollution in the marine and coastal environment include vessel traffic and emissions from terrestrial sources in coastal cities.

8.2 Biological Environment

The Kenyan coast is in the northernmost ecoregion of the eastern and southern African coastal and forest belt, which includes Kenya, Tanzania and Somalia. The climate of this ecoregion is tropical, with average temperatures above 25 degrees Celsius, little variation in day length, and generally high humidity. More than 4,500 plant species and 1,050 genera occur in this ecoregion. The ecoregion supports a diversity of species at a density among the highest in the world (WWF 2020).

The biodiversity-rich shoreline of the Kenyan coast encompasses a variety of habitats, from mangroves and wetlands, coastal forests and swamplands, to open savanna and grasslands. The coastal forests are recognised for having retained high forest biodiversity; more than half of Kenya's rare plants are found along the Kenyan coast. Other important ecosystems along the Kenyan coast include marine protected areas, freshwater ecosystems, and several community marine and terrestrial conserved areas (WWF 2020).

Kenyan coastal and marine waters support a wide variety of species, reflecting the range of habitats along the coast, including coral reefs, sea grass beds, mangroves and salt marshes (FAO 2016).

There are four major important marine environments present at the Kenyan coast (NEMA 2020): coral reefs, mangroves, seagrass beds, and intertidal flats.

The following sections draw heavily on the Marine and Coastal Ecological Study produced by WRTI as part of the impact analysis conducted for this Project (Appendix B).

8.2.1 Protected Areas

The Mombasa MPA was established in 1986 and became a formally protected area in 1991 (KWS 2021). The Mombasa MPA comprises the Mombasa MNR, which covers an area of 2.000 km^2, as well as an area with additional formal protection called the Mombasa MNP. The Mombasa MNP encompasses a 10 km^2 in the reserve (shown as a light blue rectangle within the larger green square of the reserve on Figure 8-3). The Mombasa MPA protects important coral and seagrass habitats; marine species. including crabs, starfish, stone fish, sea cucumbers, sea urchins and turtles; and bird species. The Mombasa MPA also protects the Nyali-Bamburi-Shanzu shallow lagoon system. The lagoon is bordered by Mtwapa and Tudor Creeks to its north and south, respectively (WRTI and KWS 2021). The urbanised, tourist-primed and densely populated city of Mombasa forms the shore of the MPA.

Both of the proposed branch cables cross within the Mombasa MPA:

- Approximately 2,7 km of the Mombasa North (Shanzu Beach) branch cable is proposed through the Mombasa MNR, of which 1,3 km will traverse the more highly protected Mombasa MNP.
- Approximately 14,6 km of the Mombasa South (Nyali Beach) branch cable is proposed through the Mombasa MNR portion of the Mombasa MPA.

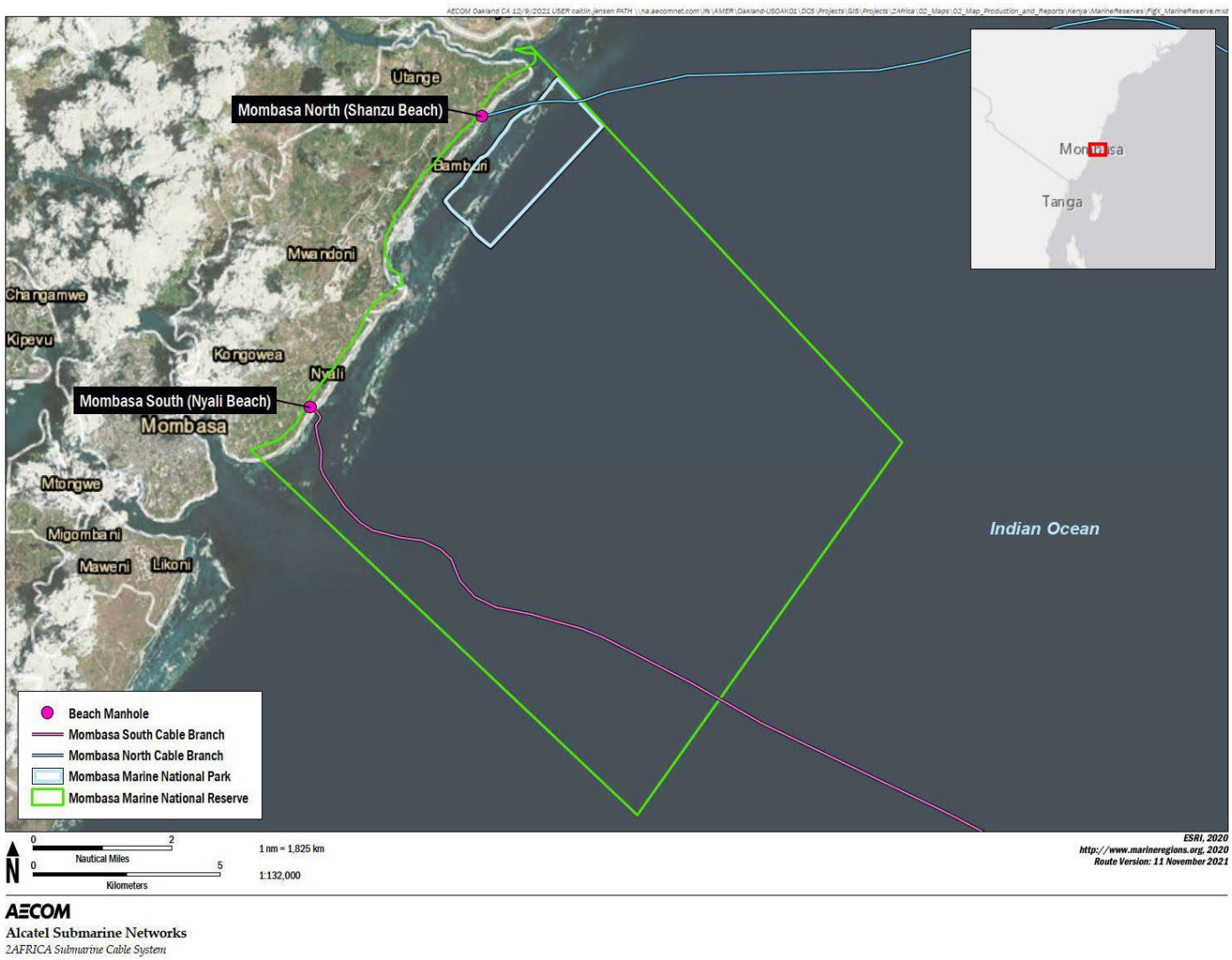


Figure 8-3 Outline of the Marine Protected Area and the proposed cable routes

8.2.2 Intertidal and Benthic Ecology

Studies of benthic habitats in Kenya have been minimal despite their ecological importance. Key benthic habitats in Mombasa include mangrove habitats, coral reefs, seagrass beds and a deep-water continental shelf. Benthic flora are represented mainly by seaweed; the fauna include bacteria, fungi, sponges, sea anemones, worms, sea stars and fishes.

8.2.2.1 Coral Reefs

Coral reefs dominate the Western Indian Ocean (WIO) ecosystem and are widely distributed along the coasts of Kenya, Mozambique, Madagascar and Tanzania. Kenya has the fewest coral reefs in the WIO, but they are the most highly protected reefs in the region. Typically, they are shallow fringing reefs, often enclosing a lagoon and closely associated with seagrass beds. Coral reefs support rich biodiversity including fish, birds, crustaceans, molluscs and echinoderms (NEMA 2017)

Kenya‘s reefs occur all along the coast except at the mouths of major rivers (the Tana and Sabaki). The southern reefs in Kenya are almost continuous fringing reefs, whereas the northern reefs are discontinuous and fall within a system of barrier island and mangrove forests. The diversity of coral species generally decreases as one moves northward along the coast (IUCN 2015).

The Mombasa MNP, situated off Shanzu Beach, harbours a rich marine ecosystem that includes coral reefs and seagrass beds, providing refuge to important and endangered species such as sea turtles, dugongs and dolphins. Patch reefs occur immediately within the lagoon in depths ranging from less than 1 m at low tide to 5 to 8 m. They fringe at leeward side of the reef crest and slope into the sand and seagrass beds to the shore. These patch reefs are characterised by a high diversity of corals, with more than 100 species on each of the patch reefs. The main reef patches are close to the cable routes, requiring careful route selection to avoid disturbing the reef (WRTI and KWS 2021).

The Shanzu coral gardens, 1.8 km from the proposed route, was discussed in the specialist study due to availability of long-term studies for this area. It can be considered representative of higher-value coral sites in the Mombasa MNP. This site is of high conservation importance and is popular area for snorkelling and diving by tourists. The site is dominated by hard coral cover (35 percent, ±29), followed by turf algae (20 percent, ±22). There are a few dead standing corals recorded, indicating the recent impact from coral bleaching events in 2010 and 2016. This patch reef has a high diversity of corals, with about 114 species out of 42 coral genera recorded. For comparison, the highest recorded coral diversity in Kenya is found at Kisite-Mpunguti Marine Protected Area (KMMPA) (236 species out of 58 genera). The most dominant coral types are *Porites* massive and *Echinopora* colonies (WRTI and KWS 2021).

Patch reefs in the Nyali area of the Mombasa MNR are used extensively for tourism, science and fishing. The outer reefs start from reef the crest/reef flat, then extend from a water depth of 9 to 25 m until sloping off into deeper waters (30 to 200 m). The reef bottoms consist mainly of hard rock substrate with coral cover, mainly *Acropora and Echinopora.*

The Nyali Coral garden site is on the southern end of Mombasa MNR. It is often visited by glass bottom boats for reef snorkelers and traditional fishing using basket traps and handlines, making it of high value to many stakeholders. The site is characterised by high macro-algae (33 percent, ±25) and turf algae (24 percent, ±17), with very low hard coral cover (<10 percent, ±13). Coral diversity is similar to the Shanzu coral gardens, with 108 species recorded. The dominant genera is *Porites* massive, followed by *Favites*. The site is highly affected by land-use activities, such as effluents from ground-water seepages on the beach and water of poor quality that flows outward from the Tudor mangrove creek. The high level of macro-algae/turf and rubble indicate significant disturbance of these reefs, mainly resulting from its proximity to groundwater seepage, high fishing pressure and recurrent bleaching episodes. The prevalence of coral rubble in the site is attributable to fishing methods such as beach seine netting, and coral trampling by speargun fishermen (WRTI and KWS 2021). The Shanzu and Nyali coral gardens are shown in Figure 8-4.

Figure 8-4: Representative photographs of the Shanzu (left) and Nyali (right) coral gardens.

8.2.2.2 Seagrass

Kenya is among the countries that have the WIO's greatest diversity of seagrasses, with 12 widely distributed species. Seagrass ecosystems are found next to shallow fringing coral reefs and mangroves. They serve as nursery grounds and foraging areas for dugong, turtles and fish. The most extensive seagrass beds of the back-reef lagoons and bays in Kenya are found in Gazi Bay (8 km from the Mombasa South [Nyali Beach] BMH); Funzi, Kilifi and Mtwapa Creeks; Mombasa; and Diani-Chale.

Seagrasses are present in the nearshore area of both the Mombasa North (Shanzu Beach) and Mombasa South (Nyali Beach) cable routes. Seagrass are the main cover in the Mombasa MNR lagoon, from deeper locations in the channel at 8 to 10 m to the intertidal area. In the Mombasa MNP area (*i.e.*, closer to the Shanzu Beach cable route), *Thalassodendron ciliatum* was the predominant species found in intertidal areas. Seagrass beds near the Nyali lagoon were affected in 2004 and 2005 by an outbreak of the grazing sea urchin *Tripneustes gratila*, which depleted seagrass beds across the entire southern Kenya coast. By 2008, after the overpopulation of urchins died off, the beds demonstrated a high capacity for recovery. Much of the artisanal fishery depends on fish that feed and/or live permanently in seagrass beds, and many of the fishing techniques are adapted from seagrass beds (WRTI and KWS 2021).

8.2.2.3 Soft-Bottom Substrates

Sandy substrates are found through the reef area. The sand is predominantly large-grained carbonate sand, generated from corals, shells, algae and other organisms growing in the reef system. There is very little terrestrial sediment in the reef system. These substrates contain a diverse assemblage of microbial and interstitial flora and fauna. Sea cucumbers are important macrofauna living in the sandy areas and processing sand for food; they are found in the Mombasa MNR because their extraction by fishermen is limited. In the Mombasa MNR lagoon, sandy bottoms are made up of clean coralline sand; in Tudor and Mtwapa Creeks, the bottoms consist of deep terrigenous silt (WRTI and KWS 2021).

8.2.2.4 Mangroves

Mangrove forests are found disbursed along the Kenya coast, with Mombasa County having 6 percent of the country's total mangrove coverage (KFS 2019). Nine mangrove species are recorded in Kenya, with *Rhizophora mucronata* and *Cerios tagal* being the most dominant. In Mombasa County, mangroves are found in Mwache, Mtwapa and Tudor Creeks (Figure 8-5). The mangrove forest nearest to the Mombasa North (Shanzu Beach) landing site is 2 km away; the mangrove forest nearest to the Mombasa South (Nyali Beach) landing is 2.7 km away.

Mombasa Island is surrounded by two main tidal creeks—Port-Reitz Creek and Tudor Creek—that are lined with extensive mangrove forests. The creeks open to the south of the MPA at English Point. A small mangrove stand lines the Nyali shore near the mouth of Tudor Creek, south of the cable landing site. To the north of the Shanzu Beach landing site, outside of Mombasa MNP, the creek mangrove community is composed of mangrove trees that grow on low-lying sedimentary shores and form well-developed forests that may show species zonation. Rare species include *eritiera littoralis Dryand* and *Xylocarpus moluccensis* (Lamk.) Roem. All of the mangroves identified are outside of the Project AOI and therefore are not considered further in this EIA.

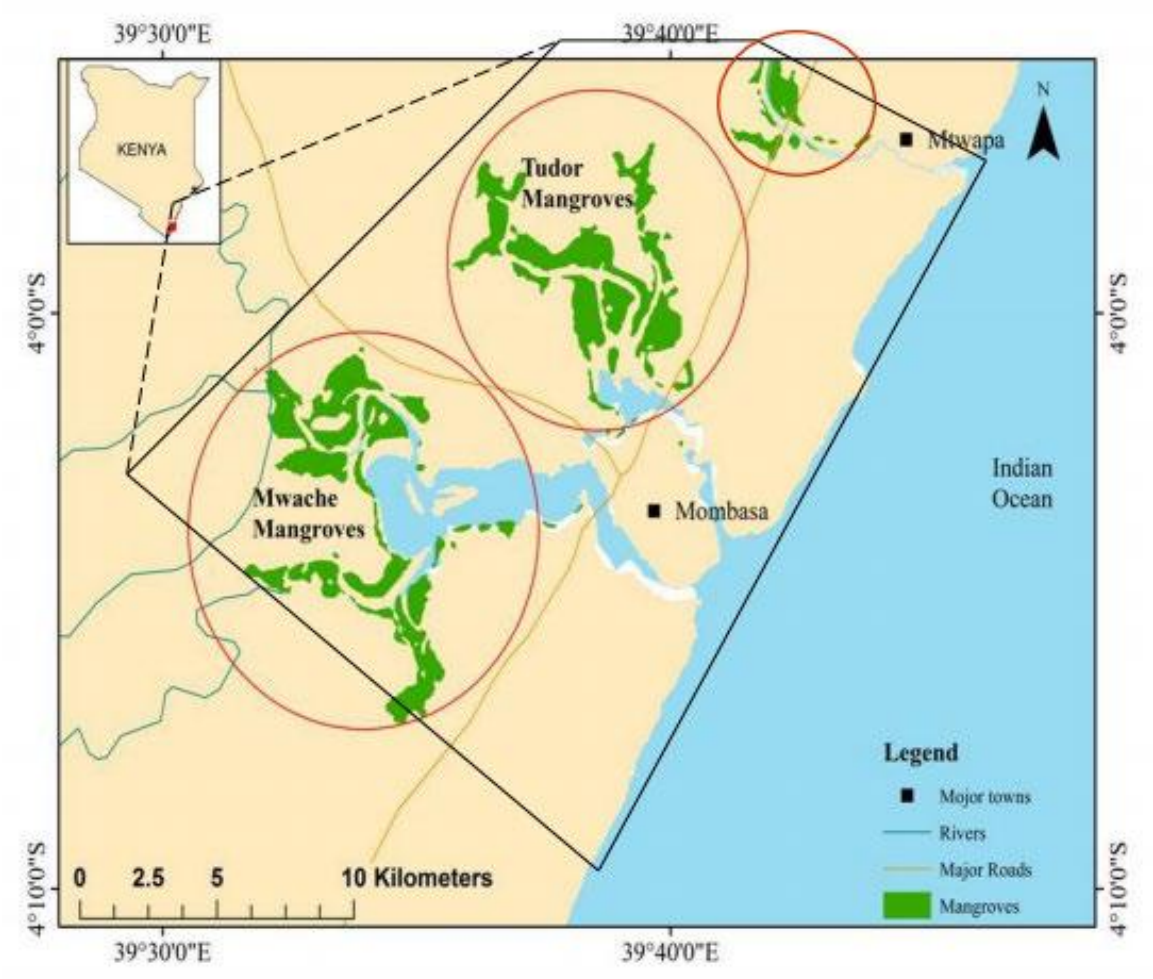


Figure 8-5: Distribution of mangrove forests in Mombasa County

Source: KFS, Mombasa Mangrove Forest Participatory Management Plan 2019-2019

8.2.3 Terrestrial Ecology

Vegetation found along the Kenyan coastline includes mangrove, palms, beach grass and sea oats, which assist in the entrapment of blowing sand. The proposed landing sites are in beach areas with high levels of anthropogenic disturbance and tourist use.

8.2.4 Fauna

8.2.4.1 Fish and Shellfish

A wide range of shark and fish species are found in Kenya's pelagic zone. A total of 45 species of sharks and rays are found in Kenyan waters and have been assessed by the IUCN. Of these, 19 are classified as threatened globally (representing approximately 40 percent of the species), and nine (representing approximately 20 percent) are categorised as near threatened. The remainder of the species were assessed either as deficient in data or of least concern (IUCN 2020).

The major fish spawning and migrating routes occur farther inshore (Pereira 2014).

The fish exploited are mainly dermersal and include scavengers (*Lethrinidae, Lutjanidae and Haemulidae*), parrot fish (*Scaridae*), and rabbit fish (*Siganidae*). Others include pelagic species such as Barracuda (*Sphyraena spp.*), Kingfish and Mullets. The crustacean fisheries are dominated by mangrove crabs harvested in the shallow waters of mangrove creeks. Spiny lobsters of the family Palinuridae are also caught in a few fishing grounds, although in small quantities. Caphalopod fisheries mainly target squid (*loliginidae*) and octopus (*Octopodidae*) (WRTI and KWS 2021).

Monitoring data of the fish species present in the MPA were collected in 2018 (Table 8-1).The numbers illustrate the average densities of fish for the Mombasa MPA (Mombasa MNP and Mombasa MNR).

Table 8-1: Average densities of fish in 12 transects of 250 m² in two seasons

Common name	*Mombasa*
Angelfish	1.00 ± 1.41
Barracuda	—
Butterfly fish	2.50 ± 3.84
Emperors	2.50 ± 5.48
Fusiliers	—
Goatfish	1.00 ± 2.00
Groupers	0.25 ± 0.83
Grunt/Sweetlips	2.83 ± 4.84
Jacks	—
Parrotfish	4.83 ± 4.45
Rabbitfish	1.25 ± 2.42
Sharks	—
Snappers	3.00 ± 2.68
Surgeon fish	5.00 ± 5.89
Triggerfish	0.58 ± 0.86
Wrasses	3.25 ± 2.13

Source: WRTI and KWS 2021

Observed fish density and diversity in the Nyali coral garden, near the Mombasa South (Nyali Beach) landing point is low (four individuals per 250 m^2) and consisted of mainly small individuals (<15 cm). Fish density was not provided in the Marine Specialist Study for Shanzu Coral Gardens, but is expected to be higher than in Nyali, due to the higher quality of habitat and lower levels of disturbance in the Mombasa MNP (see Figure 8-4).

8.2.4.2 Marine Mammals

Several species of whales and dolphins have been recorded in Kenyan marine waters. The most common whale species is humpback whale (*Megaptera novaeangliae*) (IUCN Least Concern). Other species include minke whale (*Balaenoptera acutorostrata*) (IUCN Least Concern), Bryde's whale (*Balaenoptera edeni*), toothed sperm whale (*Physeter macrocephalus*) (IUCN Vulnerable), killer whale (*Orcinus orca*) (IUCN Data Deficient), false killer whale (*Pseudorca crassidens*) (IUCN Near Threatened), melon-headed whale (*Peponocephala electra*) (IUCN Least Concern) and, most recently, blue whale (*Balaenoptera musculus*) (IUCN Endangered). According to NEMA (2020), three of these species are listed as endangered and three as vulnerable.

Dolphin species include Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) (IUCN Near Threatened), pantropical spotted dolphin (*Stenella attenuate*), common dolphin (*Delphinus delphis*) (IUCN Least Concern) and spinner dolphin (*Stenella longirostris*) (IUCN Least Concern). The IUCN Endangered humpback dolphin (*Sousa plumbea*) is found occasionally in Kenya's coastal and marine waters (IUCN 2020).

Studies have indicated that Blue whales are commonly sighted offshore of the fringing reefs of Mombasa and rarely come into inshore waters. Humpback whales migrate north and south along the Kenya coast annually and are frequently sighted off Malindi and Shimoni. As top-level predators, they impact local food webs and ecosystems and serve as important indicators of the health of marine environment. The Mombasa MNP has been reported to be part of the home range for dolphins (KWS 2016).

8.2.4.3 Turtles

Five of the world's seven species of sea turtles are found in Kenyan marine waters. These are hawksbill (*Eretmochelys imbricata*), loggerhead turtle (*Caretta caretta*), olive ridley (*Ledpidochelys olivacea*), leatherback turtle (*Dermochelys coriacea*) and green turtle (*Chelonia mydas*). These five species are on the IUCN Red List of Threatened Animals, with hawksbill turtle listed as critically endangered; green turtle, listed as endangered; and leatherback, olive ridley, and loggerhead turtle listed as vulnerable.

All three of the endangered sea turtle species forage and breed on Kenya's beaches. The green turtle is the most common species in Kenyan waters, constituting approximately 97 percent of reported nests, followed by hawksbill at 2.5 percent and olive ridley at 0.5 percent (NEMA 2017; IUCN 2020). Key nesting sites on the Kenyan coast include Jumba Ruins, Kijipwa, Nyali, and Kiungawini and Mongo Sharriff along Kiunga Beach. Turtles feed in the lagoons and lay eggs (nest) at the edge of the highest tide zone on sandy beaches. Although previously common around Mombasa, as elsewhere, they are now infrequently seen.

Sea turtles used to commonly nest throughout the beaches between Mtwapa Creek and Tudor Creek. However, due to loss of nesting grounds caused by erection of seawalls and installation of lights along the beach, turtles currently nest only in specific sites along the stretch. These include English Point, Mkomani in the south, Nyali Beach, and Shanzu Beach.

Safe turtle hatcheries have been identified near Serena Beach Resort at Nyali Beach and the PrideInn Paradise Beach Resort on Shanzu Beach. Eggs laid in unsafe nests are usually relocated to the hatcheries to protect the eggs and increase the survival of the hatchlings (WRTI and KWS 2021).

Turtle nesting season is year-round in Kenya, and peak nesting times vary dramatically by location. Peak nesting season near Mombasa typically occurs from November to February (Okemwa and Nzuki 2004). KWS, in collaboration with the local community, undertakes regular surveys to identify nesting sites. In 2021, a total of 48 nests were recorded. Of these, 36 (75 percent) were recorded in Nyali and Shanzu, as indicated in Table 8-2. The KWS data suggest that turtles nest year-round in both locations, with the most nests identified between March and May.

Table 8-2: Sea turtle nesting frequency along the MPA sandy beach

Month	Middle	Nyali	Shanzu	South	Total
January			3		3
February			3		3
March	1		6		7
April		1	6	2	9
May		2	2	2	6
June		3	2		5
July		1		3	4
August	1	1		2	4
September	1				1
October			1		1
November			2		
December			3		
Total	**3**	**8**	**28**	**9**	**48**

Source: WRTI and KWS 2021

Notes:
MPA = Marine Protected Area

8.2.4.4 Birds

Important bird areas along the Kenya coast include Arabuko Sokoke Forest, Kaya Waa, Kaya Gandini, Diani Forest, Mida Creek, Whale Island, Shimba Hills, Gede Ruins, Kiunga MNP and Reserve, and Sabaki Estuary. The closest of these to the proposed landing sites is the Kaya Waa Ecoforest, approximately 19.7 km from the Mombasa South (Nyali Beach) landing.

Seabirds are avian species that spend a large part of their lives at sea. They mainly rely on marine habitats for food, including fish, squid, crabs and molluscs. The main threat to both resident and migrant birds in the WIO is habitat degradation, which affects breeding and nesting sites. Other threats include disturbances by fishermen/women and tourists, egg collection, predators (*e.g.*, dogs, cats and rats) and pollution.

Seabirds use the terrestrial environment for reproduction and rearing young, and the benthic coastal marine and pelagic ocean for foraging or feeding (NEMA 2017). Kenyan marine waters support a number of migrant terrestrial and seabird species, including crab plovers, sand plovers, Caspian tern, gull-billed tern, lesser crested tern, masked booby, roseate tern, Saunders tern, sooty gull and lesser noddies (Birdlife International 2020). These species are all classed as of least concern on the IUCN Red List.

Terrestrial birds stay and nest on the ground. Examples of terrestrial birds along the Kenyan coast include helmeted guineafowl (*Numida meleagris*), hadada ibis (*Bostrychia hagedash*) and yellow-necked spurfowl (*Francolinus leucoscepus*).

8.2.4.5 Endangered Faunal Species

Kenya's coastal marine area falls within the WIO, a globally recognised ecosystem that supports threatened, endangered and critically endangered species. Therefore, several marine and coastal species that are included on the IUCN Red List are found in Kenya's marine waters and along its coastline, as shown in Table 8-3 (IUCN 2020).

Table 8-3: IUCN red-list species identified in Mombasa and in the Western Indian Ocean

Species	Common Name	Conservation Status
Sphyrna mokarran	great hammerhead	Critically Endangered
Pristis pristis	large-tooth sawfish	Critically Endangered
Pristis zijsron	green sawfish	Critically Endangered
Pseudoginglymostoma brevicaudatum	short-tail nurse shark	Critically Endangered
Rhynchobatus australiae	bottlenose wedge fish	Critically Endangered
Carcharhinus longimanus	oceanic whitetip shark	Critically Endangered
Sphyrna lewini	scalloped hammerhead	Critically Endangered
Aetomylaeus vespertilio	ornate eagle ray	Endangered
Eretmochelys imbricate	hawksbill sea turtle	Critically Endangered
Dermochelys coriacea	leatherback	Vulnerable
Otus ireneae	Sokoke scops owl	Endangered
Rhincodon typus	whale shark	Endangered
Alopias pelagicus	pelagic thresher	Endangered
Stegostoma tigrinum	zebra shark	Endangered
Isurus paucus	longfin mako	Endangered
Mobular mobular	giant devil ray	Endangered
Rhincodon typus	whale shark	Endangered
Sousa plumbea	Indian Ocean humpback dolphin	Endangered
Stylophora madagascarensis	cat's paw coral	Endangered
Acropora roseni	table coral	Endangered
Balaenoptera musculus	blue whale	Endangered
Megaptera novaeangliae	humpback whale	Endangered
Chelonia mydas	green turtle	Endangered
Caretta caretta	loggerhead	Vulnerable
Ledpidochelys olivacea	olive ridley	Vulnerable

Source: IUCN 2020

The species shown in Table 8-3 are protected species under Kenyan law, as outlined in the Wildlife Conservation and Management Act. The following marine animals also are protected under this legislation:

- dugong (*Dugong dugon*)
- sperm whale *(Physeter macrocephalus)*
- bigeye tuna (*Thunnus obesus*)
- porcupine ray (*Urogymnus asperrimus*)
- great white shark (*Carcharodon carcharias*)
- bowmouth guitar fish (*Rhina ancylostoma*)
- black-blotched stingray (*Taeniura meyeni*)
- brindle bass/giant grouper (*Epinephelus lanceolatus*)

The frequency of sightings of cetaceans is highly seasonal. For example, the humpback whale frequently is sighted between August and October, coinciding with the peak breeding and calving periods (IWC 2020).

8.3 Human Environment

8.3.1 Demographics and Socioeconomic Context

Mombasa County is in the coastal region of Kenya. It borders Kwale County to the Southwest, Kilifi County to the North and the Indian Ocean to the East. The County is divided into six subcounties—Mvita, Nyali, Changamwe, Jomvu, Kisauni, and Likoni—and thirty county assembly wards. These are further subdivided into 30 locations and 47 sublocations (NEMA 2020).

Population distribution and settlement patterns in Mombasa County are influenced by proximity to vital social and physical infrastructure networks such as roads, housing water and electricity. The current population in the county is approximately 1.2 million, out of which 657,288 are male and 609,069 are female. The population is projected to rise to 1.4 million by 2022 (CGoM 2018). According to a Kenya National Bureau of Statistics report in 2019, tourism contributed 45 percent of the coastal economy; ports and shipping contributed 15 percent (NEMA 2020).

Mombasa is a major trade centre due to the port in the south of the city. The port is a major contributor to the Kenyan economy, with the shipping and port activities accounting for approximately 15 percent of the regional economy. It is a major source of employment in the area, attracting labour not only within the region, but also from other parts of the country. The types of activities that occur include manufacturing and processing, cement manufacturing and oil refinery. Limestone mining also occurs in the region.

Shanzu Beach has several luxury hotels that attract a large number of international and domestic visitors. The beach is also used by local residents and is accessible via the public access road. As a result, multiple businesses have been set up in the area to cater to tourists and local beach users. These include retail vendors selling items on the beach (clothing and other beach items); boat excursions to the reef for swimming and snorkelling; and camel rides (see Figure 8-6).

Because it is in the marine park, no fishing/catch landing occurs in this location; however, fishermen do use Mtwapa Creek, which is just to the north of the beach.

Figure 8-6: Local beach vendors selling products to tourists and boats offering excursions at Shanzu Beach around the Mombasa North (Shanzu Beach) landing site

Source: AECOM

Nyali's attractive white sand beach also attracts a large number of international and domestic tourists. The section of the beach near the proposed landing site is fairly busy, having multiple access roads and being close to large residential areas. Similar to Shanzu Beach, there are a number of small businesses near the Mombasa South (Nyali Beach) landing site, such as food and drink vendors, boat excursions, camel rides, beach games/activities and venue hiring (see Figure 8-7).

Figure 8-7: Socioeconomic activities at Nyali Beach around the Mombasa South (Nyali Beach) landing site

8.3.2 Cultural Heritage

8.3.2.1 Terrestrial Cultural Sites

The Kenyan coastal region has many historical and archaeological sites, including old mosques, tombs, mounds and walls of ancient city houses, many of them linked with the development of the Swahili culture in East Africa. Some historical sites, such as the Mombasa and Lamu Old Town, have been designated Conservation Areas and are managed by the NMK. The Siyu Fort has been declared a National Monument under the National Museums and Heritage Act (2006) (NEMA 2020). These sites are note visible from the Project footprint.

The history of Mombasa as a centre for trade can be traced to the sixteenth century, when traders attempted to enforce their governance on the town because of its advantageous location. Mombasa remained the centre of Arab trade in ivory and slaves from the sixteenth to the eighteenth century. Mombasa is inhabited by people of different cultures, including locals, Arabs, Portuguese, and the British. This is evident in the collection of historical buildings dating from the eighteenth century, which

combines African, Arabic and European influences. Many of these buildings still exist, including Fort Jesus, the Old Town and Jumba la Mtwana (GOK 2020).

According to previous environmental studies undertaken in the Nyali area, archaeological sites with prehistoric stone implements dating to the Middle stone age were observed in limestone quarries in the area.

No known cultural heritage or living heritage sites were identified in the proposed landing area or its immediate vicinity.

8.3.2.2 Marine Archaeological Sites

The NMK has located more than 30 shipwrecks in the Indian Ocean, some dating to 500 years ago. All shipwrecks found underwater are properties of the Kenyan government. The shipwrecks are protected as underwater museums to be preserved for future generations (Nation 2020). The Project team consulted with the NMK and received no indication of known wrecks along the cable route in Kenyan waters. The marine survey undertaken as part of the cable route design identified a shipwreck in the shallow waters of Mombasa at latitude 4° 4'44.51"S, longitude 39°43'14.21"E (Figure 8-8 and Figure 8-9). No other points of archaeological interest were found in the survey route.

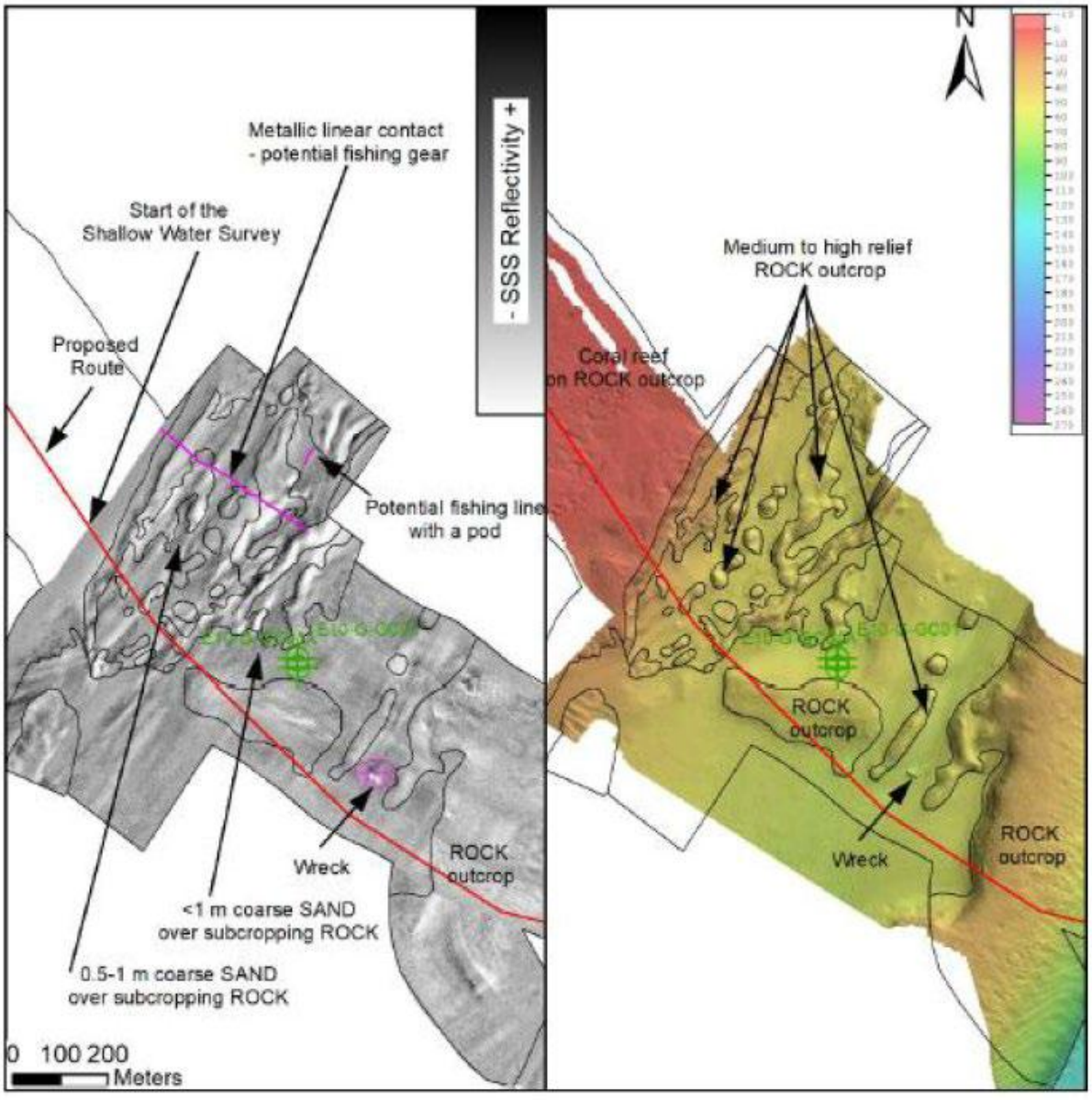


Figure 8-8: Fugro marine survey of Mombasa indicating the shipwreck location

Source: Fugro 2021

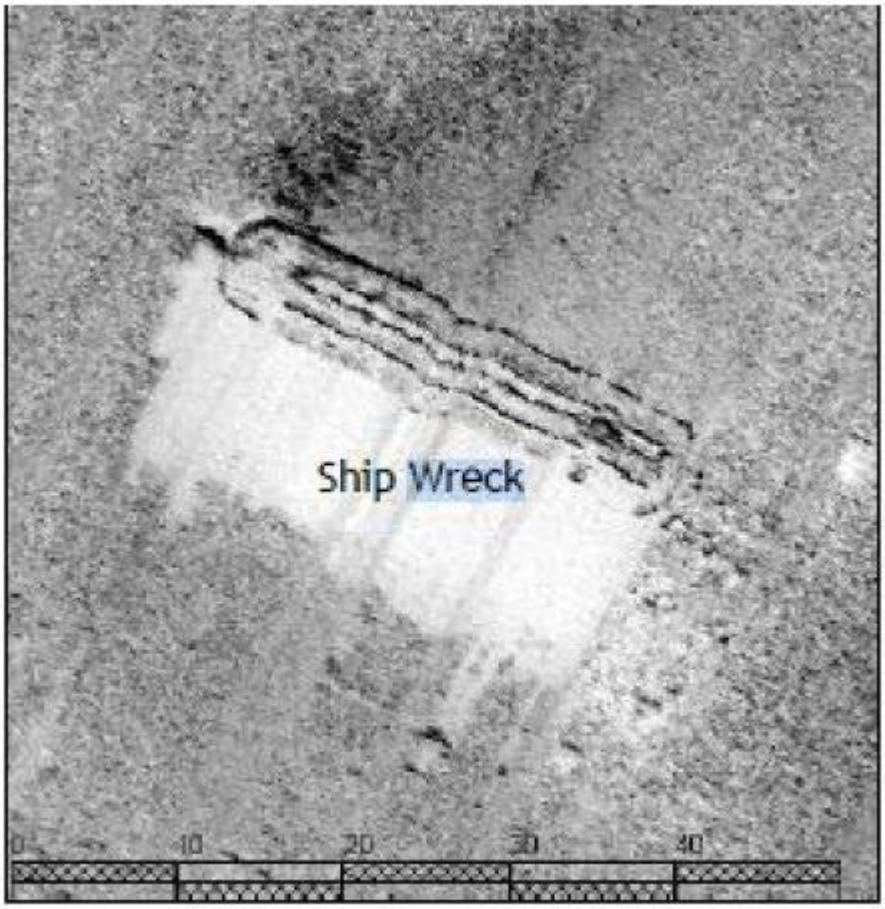


Figure 8-9: Shipwreck sonar contact identified in the shallow water in Mombasa South (Nyali Beach)

Source: Fugro 2021

8.3.3 Recreation and Tourism

Tourism is an important and diverse industry in Kenya, contributing 4.1 percent of national gross domestic product in 2014 (KNBS 2016). Coastal tourism relies heavily on natural resources such as national parks and reserves, and coastal beaches, as well as conferences and events, historical sites and ecotourism. According to the World Travel and Tourism Council (2018), travel and tourism directly supposed 429,500 jobs in 2017.

Mombasa is a major tourist attraction site, with beautiful beaches and a unique cultural history. In 2013, the Ministry of Tourism and Cultural Development teamed up with Travel Foundation to change the face of tourism in Mombasa (Travel Foundation 2013). This involved collaborating with local stakeholders; working with trade associations to produce formal guidelines for codes and conduct; training more than 500 beach sellers; and encouraging engagement between the hotels and beach sellers to work together for mutual benefit.

Beach tourism in Mombasa County occurs primarily in three popular areas, Nyali, Bamburi and Shanzu area, stretching some 13.5 km. Proximity to Mombasa, white sand beaches, and the presence of the marine reserve contribute to the popularity of the area for tourism. There are several hotels in Nyali and Shanzu that are visited by both locals and international travellers. Recreational activities in the proposed Project area include swimming, snorkelling, scuba diving, boating, sunbathing, beach sports/games, and camel riding. Additional information on local tourism and economic activities at the proposed landing sites is provided in Section 3.1 and Section 3.2.

8.3.4 Fishing

Marine fisheries in Kenya can be classified into two subsectors: the coastal artisanal fishery and the EEZ fishery.

The fishing season in Mombasa coincides with the peak tourism season, between December and March (FAO 2016). Fishing is mainly undertaken in the nearshore reef lagoons or fringing back reef throughout the year during the northeast monsoon, from January to July. The coastal artisanal fishery is generally a subsistence category, operated by small crafts. Deeper-water fishing in the broader EEZ is characterised by distant-water fishing vessels that exploit target species, mainly with purse seines2 and long-line fishing techniques (FAO 2016). Commonly targeted species near the MPA include rabbitfish, emperors, snappers and parrotfish (WRTI and KWS 2021). Marine fish and fish products are exported to various countries worldwide. This includes aquarium fish, which provide the highest value-added product obtained from reefs. In the WIO region, Kenya is the largest exporter of marine aquarium fish.

Distinct fish landing areas along the Kenyan coastline include (Kakunde 2012):

- Funzi-Shirazi Bay
- Diane-Chale area
- Mombasa-Kilifi North Coast
- Malindi–Ungwana Bay
- the Lamu Archipelago

Artisanal fisheries along the Kenyan coast support the livelihoods of thousands of coastal communities. It is currently estimated that about 10,000 fishermen are directly engaged in artisanal fishing along the Kenyan coast (WRTI and KWS 2021). Annual marine fish production from artisanal fisheries is estimated to be about 9,000 metric tonnes, which is equivalent to 7 percent of the national fish production from capture fisheries. There has been a general increase in fishing pressure along the coast, with about 13,426 small-scale fishers reported to be involved in fishing in 2016 (NEMA 2017). The main catches have been reported to include demersal reef fish, dominated by rabbitfish, parrotfish and emperors; pelagic species, including tuna; shellfish, including molluscs and crustaceans (prawns and lobsters); and octopus and squid.

Traditionally, the coastal communities have depended on fisheries as an important part of the livelihoods for many households living in Mombasa (GOK 2012). Fishery resources continue to be exploited through simple dugout canoes and traditional fishing gears. Artisanal fisheries in the Mombasa MNR area are mainly undertaken with handline and basket traps. Other methods such as spear guns, monofilament and beach seine netting are banned in the area, but evidence suggests that they continue to be used nonetheless (GOK 2012). Modes of access to the fishing grounds and fishing vessels or crafts employed in the fishery include travel by foot or swimming, dugout and plank canoes, double outrigger, motorboats and fibreglass boats. Fishing is mainly undertaken in the nearshore reef lagoons or fringing back reef throughout the year, especially during the northeast monsoon season (January through July), when the sea conditions are relatively calm (Obura 2001). Fish catch is lower during the southeast monsoon, (May through September).

The Kenyan fishing industry is co-managed through BMUs, established by the Fisheries Department, Ministry of Fisheries Development in 2006 (FAO 2012). The Director of Fisheries facilitates the establishment of a BMU for each fish landing station, in accordance with the provisions of the Fisheries Act and the Fisheries Regulations, 2007 (Cap. 378). BMUs consist of fishermen, fish traders, boat operators, the Kenyan government, local organizations and other beach and marine stakeholders (WRTI and KWS 2021). The BMU's primary objective is to support sustainable fisheries along the Kenyan coast, which is accomplished in their individual jurisdictions through landing station management, conflict mediation and monitoring of fisheries and fishing output. At least 12 BMUs have authority in Mombasa County, and more are proposed for development (Mombasa County 2013).

[2] Purse seines are nets used in the open ocean to target dense schools of single-species pelagic (midwater) fish, such as tuna.

There are no fish landed on Shanzu Beach; fishermen use a creek to the north of the beach for fishing. One of the fish landing sites in the Mombasa area is on Nyali Beach.

8.3.5 Public Health and Safety

In 2006, Kenya adopted a community-based approach (Community Health Strategy). This was articulated in the second National Health Sector Strategic Plan, which defined the health care service delivery to Kenyans. Every 5 years, the health strategy is updated and developed based on the lessons learnt from the implementation of the previous health strategy. The current Health Strategy aims to integrate community health into wider health systems in part by fostering strategic partnerships and accountability among stakeholders at all levels of health systems in Kenya (Kenya Ministry of Health 2020). The health challenges of Kenya include high maternal and child mortality and a high burden of infectious disease such as HIV, tuberculosis and malaria. The Centre of Disease and Control of Kenya works in close partnership with government to address the burden of disease in Kenya and improve its health systems.

In 2020, the Ministry of Health launched the National Response and Emergency Committee to steer Kenya's COVID-19 prevention, containment and mitigation.

8.3.6 Shipping and Navigation

The Kenya Ports Authority (KPA) is responsible for managing and operating the Port of Mombasa, which has been the hub for international trade since its construction in the late nineteenth century. It is the largest seaport in Kenya and serves other countries further inland, including Uganda, the Democratic Republic of Congo, Southern Sudan and Rwanda. In addition, the Port serves the hinterland by exporting agricultural products. The Port handles between 1,684 and 1,832 vessels annually, sailing to Europe, North and South America, Asia, the Middle East, Australia and the rest of Africa. The Port is a natural deep harbour, with 19 berths; six of these are fully fledged container-handling berths, and two are for cruise vessels (KPA 2018).

The Mombasa harbour has a high density of marine traffic. As shown in Figure 8-10, the highest levels of ship traffic occur in the mouth of the Kilidini Port (Port). The Port does not have a Traffic Separation Scheme or a primary anchorage. Therefore, the ship counts farther outside the port entrance likely include ships counted more than once while at anchor. The Mombasa South (Nyali Beach) cable branch crosses an area of relatively high ship traffic but avoids the highest density corridor at the port entrance.

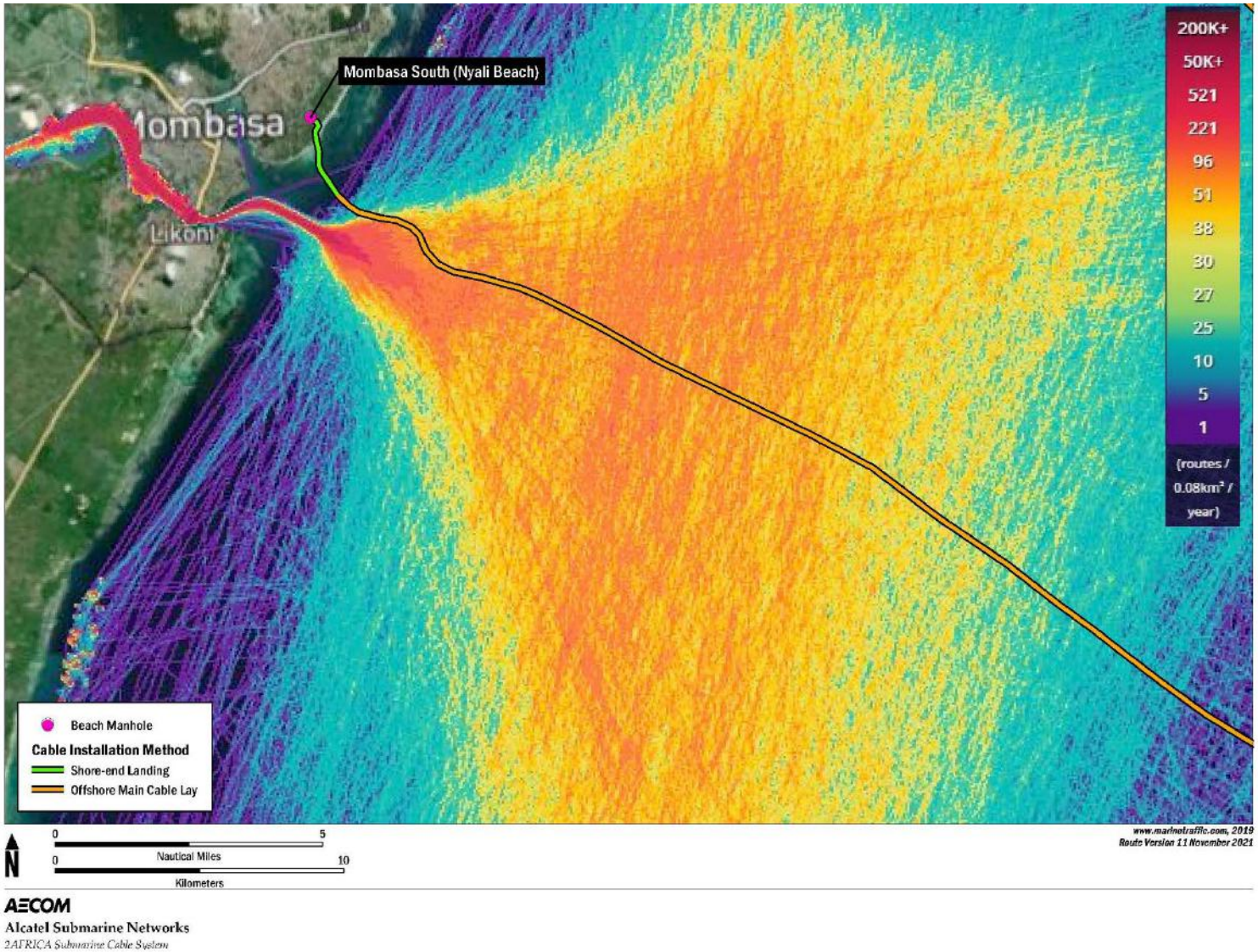


Figure 8-10: Marine Traffic Data for 2020, Port of Mombasa

Source: Marine Traffic

9. Impact Assessment Methodology

This chapter describes the methodology that will be used to evaluate potential environmental and social impacts associated with the installation and operation of the Project. It outlines the key stages of the assessment process and the approach taken to identify and evaluate the potential impacts and effects associated with the Project.

The assessment methodologies take into account the requirements of the Kenyan EMCA, 2015, as well as relevant best international practice, including:

- IFC Performance Standards;
- The UK Institute of Environmental Management and Assessment: Suite of General and Topic Specific Guidelines for Environmental Impact Assessment (various dates); and
- The UK Chartered Institute of Ecology and Environmental Management: Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal (2010).

The Project has integrated environmental and social considerations into the route design and optimisation process, including desktop studies and a marine survey. The route design and optimisation process aim to avoid or reduce disturbance of known sensitive environmental and social receptors wherever possible.

9.1 Impact Description

9.1.1 Positive or Negative Impact

Positive impacts are impacts that are beneficial to the environmental or social receptor.

Negative impacts are impacts that are detrimental to the environmental or social receptor.

9.1.2 Direct or Indirect Impact

Direct impacts are impacts that are caused by a Project action and occur at the same time and location as the activity.

Indirect impacts are impacts caused by a Project action, but which occur later in time or are farther removed in distance but can be reasonably foreseen. Indirect impacts may include impacts related to induced changes in the pattern of use of the marine area, or related effects on air and water and other natural systems, including ecosystems.

9.1.3 Impact Duration

Short-term (temporary) impacts are impacts of less than 1 year in duration.

Medium-term impacts are impacts of between 1 and 10 years in duration.

Long-term (permanent) impacts are impacts of more than 10 years in duration.

9.1.4 Impact Reversibility

An impact is reversible when there is a possibility that the affected environmental factor will return to conditions similar to those it had before the impact occurred.

An impact is irreversible when the possibility of the affected environmental factor returning to conditions similar to those it presented before the impact of the impact does not exist or is negligible.

9.1.5 Impact Scale

An impact is local when the effects on the environmental factor in question are restricted to a local extent; for the socioeconomic environment, spatial coverage is local when the impact is restricted to a municipality.

An impact is regional when the effects on the environmental factor in question reaches a regional extent; for the socioeconomic environment, spatial coverage is regional when the impact affects more than one municipality.

An impact is national or international when the effects on the environmental factor in question have a national, continental or global character; for the socioeconomic environment, coverage is supra regional when the impact affects more than one municipality and is national, continental or global.

9.1.6 Cumulative Impact

Cumulative impacts are the additive impacts resulting from the impacts associated with the Project, when considered in combination with any other development activity proposed in the anticipated area of impact, at the same time.

9.2 Impact Magnitude

The magnitude of a predicted impact is defined as the extent of change that may be expected and is likely to be as a result of a range of factors, including:

- the anticipated geographic area that may be affected;
- the duration and frequency of an impact; and
- the degree of environmental or socioeconomic change and/or level of community concern.

Table 9-1 sets out guidance for the consideration of potential impact magnitude.

Table 9-1: Impact magnitude – indicative criteria

Definition	Indicative Description of Impact*
No effect	• No measurable change from background levels (ecosystem, population, natural resources) • Imperceptible or negligible • Social, economic or cultural impact is 'imperceptible' or unlikely to be noticed
Slight	• Small change but nonetheless measurable relative to background levels • Highly localised to the immediate vicinity (*e.g.*, within approximately 500 m) • Short term • Not expected to contribute to cumulative effects
Minor	• Measurable change relative to background levels • Changes might be noticeable but fall within the range of normal variation • Impacts felt at local level and/or a group of individuals of a population at a localised area and/or over a short period (one generation or less) • Short term • Impact is not expected to contribute to cumulative effects • Changes in social, economic or cultural dynamics with minor and temporary effect on any given sector performance and/or population well-being • Limited impact to archaeological, cultural or natural resources • Unlikely to result in concerns being raised by governmental bodies or stakeholders • Can be positive or negative • Mitigation measures for negative impacts, if required, can be readily implemented

Definition	Indicative Description of Impact*
Medium	• Large change relative to background levels (ecosystem, population, natural resources) and likely to contribute to cumulative effect • Changes exceed the range of natural variation • Impacts may be felt at regional level and/or affect a portion of the population or species over one or more generations but does not change the integrity of the population as a whole • Impacts may be medium to long term • Changes in social, economic or cultural dynamics with moderate and noticeable adverse effect on any given sector performance and/or population well-being • Involves damage to archaeological, cultural or natural resources of local importance • Such impact may result in concerns being raised by governmental bodies or stakeholders • Can be positive or negative • Negative impact can be minimised or avoided by application of specific mitigation measures • After mitigation, residual impacts may require monitoring
High	• Substantial change to the baseline and long-term (>5 years) changes in an ecosystem • Changes are well outside the range of natural variation, and assisted rehabilitation might be required • May affect the whole population or species, causing a change in abundance and/or distribution, or the size of genetic pool such that natural recruitment would not return to that population, or any population of species dependent upon it • Impacts may be widespread • Impact may be a major contributor to cumulative effects • Changes in social, economic or cultural dynamics with major adverse effect on any given sector performance and/or population wellbeing • Involves damage or permanent loss to archaeological, cultural or natural resources of international/national importance • Such impacts may result in immediate intervention by governmental bodies and stakeholders • Can be positive or negative • Negative impact may be difficult to mitigate and/or irreversible

Notes:

* Professional judgement will be applied to the specific circumstances and these descriptions will be used for guidance.

m = metres

9.3 Impact Receptor Sensitivity

Receptor sensitivity criteria (Table 9-2) have been applied taking account key factors including:

- relevant legislative or policy standards or guidelines;
- the relative value or importance of the receptor at local, national or international level (the importance of a receptor may relate to biodiversity, ecosystem services, cultural or economic significance); and
- the vulnerability of a receptor, its capacity to absorb change and its ability to recover from an impact.

Table 9-2: Receptor value/sensitivity – indicative criteria

Definition	Indicative Description
Not sensitive	• Resilient to Project activities • The receptor is resistant to change or is of little environmental or social value
Low	• Receptors with limited value or importance attached to them, even at the local level • Easily adaptable to change or likely to recover immediately (within days/weeks)
Medium	• Receptors of importance at a local level • The receptor has moderate capacity to absorb change without significantly altering its present character and/or recovery is likely within 1 to 2 years of cessation of activities or highly localised medium-term recovery (2 to 5 years)
High	• Receptors of importance at the local and national level • The receptor has a low capacity to absorb change without fundamentally altering its present character and is of high environmental or social value • Species of potential conservation significance and/or recovery likely 5 to 10 years following cessation of activity, or that cannot easily be recovered
Very high	• Receptors of importance at an international level • The receptor has little or no capacity to absorb change without fundamentally altering its present character, is of very high environmental or social value • Species of potential conservation significance and/or recovery likely only over an extended period (more than 10 years) following cessation of activity and/or a permanent deleterious effect

9.4 Impact Significance

The magnitude of impact and sensitivity of receptor is then combined to determine the predicted significance of any impacts, as shown in Table 9-3.

Table 9-3: Impact significance matrix

		Sensitivity				
		Not Sensitive	Low	Medium	High	Very high
Magnitude	No effect	No effect	No effect	No effect	No effect	No effect
	Slight	Negligible	Negligible	Minor	Minor	Minor
	Minor	Negligible	Minor	Minor	Moderate	Moderate
	Medium	Minor	Minor	Moderate	Moderate	Major
	High	Minor	Moderate	Moderate	Major	Major

9.5 Environmental Risk (Unplanned Events)

In addition to the above-listed considerations, when considering unplanned events, the likelihood of an event occurring also requires consideration. In this case, the indicative likelihood criteria listed in Table 9-4 and Table 9-5 have also been applied.

Table 9-4: Indicative likelihood criteria for unplanned events

Definition	Indicative Description*
Remote	Never occurred during company's activities but has been known to occur in the wider industry
Unlikely	Has occurred in company's activities in the past but as an isolated incident under exceptional circumstance
Occasional	Has occurred on more than one occasion during company's activities in the past
Likely	Occurs regularly during company's activities

Note:

* Professional judgement will be applied to the specific circumstances and these descriptions will be used for guidance.

Table 9-5: Indicative environmental risk

		Likelihood			
		Remote	Unlikely	Occasional	Likely
Impact Significance	No effect	No effect	No effect	No effect	No effect
	Negligible	Negligible	Negligible	Minor	Minor
	Minor	Negligible	Minor	Minor	Moderate
	Moderate	Minor	Minor	Moderate	Major
	Major	Moderate	Moderate	Major	Major

10. Impact Assessment

10.1 All Phases

10.1.1 Vessel Use

Vessel use is applicable to the pre-installation works, cable-lay and cable-landing phases of the Project, both in the Kenyan territorial sea and the EEZ.

Project vessels may include (but are not limited to) the cable ship, guard boats, dive support boats, survey boats, maintenance crews and other support vessels. These additional vessels would be present in the Kenyan territorial sea and the EEZ during the installation activities when working (*e.g.*, during route clearance; cable laying and burial; and during the shore-end landing), and when in transit. Additional vessel activity is not anticipated during the operational phase of the Project, except in the unlikely event of a cable repair. In the event of a cable repair, vessel activities would be similar to the cable-laying activity and limited to the area of the repair.

10.1.1.1 Increase in Vessel Traffic and Temporary Access Restrictions

Impact Description

In the EEZ, the cable-lay vessel (or similar) is expected to require about 10 days to complete clearance activities; 10 days for installation; and 7 days for post-installation inspection and burial for the two cables combined (see Section 3.3.4). The cable-lay vessel will travel at slow speeds during installation—*i.e.*, from 0.3 knot during burial up to 4 knots for surface lay in hard-bottom areas and in deep water (deeper than 1,000 m). As shown in Figure 3-18, the cable will be buried where feasible throughout territorial seas, including the sections of the route crossing higher-use traffic areas (Figure 8-10).

The cable route approach to the Mombasa North (Shanzu Beach) landing avoids the most heavily trafficked transit area off the Port of Mombasa. Approximately 18.7 km (10.1 nautical miles) of the cable route to the Mombasa South (Nyali Beach) landing crosses an area of relatively high vessel traffic but avoids the highest density transit areas outside the port entrance. In this area, the cable-lay vessel will be travelling at slow speeds—between 0.3 knot and 4 knots—as it installs the cable. The vessel will provide advance notice to the Maritime Authority and maintain regular communication with the Authority as needed to notify other vessels of the programme.

The increase in vessel traffic will affect other sea users in the immediate vicinity of the cable installation activities. The Kenya Maritime Authority will be notified in advance of any operations so that shipping and other vessels can be notified. Large and small vessels will need to maintain a buffer of 1 nautical mile from the cable ship during the main-lay operation.

There will also be a minor increase in vessel use associated with the two shore-end landings. This will include the presence of support vessels (guard boats, dive boats, etc.) for the cable-lay and diving operations. The duration of each landing is approximately 1 day, followed by 7 to 10 days of post-installation activity (*i.e.*, articulated pipe application and burial by divers). During this time, between two and five small vessels may be present in the nearshore area, including guard boats to maintain a safety buffer around in-water activities.

During the shore-end landings and post-installation diver activities, recreational, fishing and other small craft will need to avoid the immediate area of the cable installation activities on a given day, for the safety of divers in the water. This impact will last for 7 to 10 days in total but will only affect a small section of the cable at a time.

With the implementation of in-built mitigation measures, including early notification and coordination with maritime and fisheries groups, the significance of impacts from increased vessel traffic and temporary access restrictions will be **minor.**

Assessment:

Receptors	**Physical**	**N/A**
	Biological	**Protected Areas and Species:** The increase in vessel traffic in the MPA will be small compared to existing levels of recreational and commercial vessel activity. For marine mammal interactions, see Section 10.1.1.6.
	Human	**Recreation and Tourism:** Vessel traffic during the nearshore installation may impact boat excursions to the reef for swimming and snorkelling within a narrow corridor around installation activities. **Shipping, Navigation and other Sea Uses:** Cable-laying activities could potentially interfere with the movement of international and local vessels travelling along shipping routes, particularly in the approach to the Port of Mombasa. Commercial fishing activities tend to occur in deeper waters; local subsistence fishing activities tend to occur in shallow waters. Artisanal fishermen, tourist operators and other locals who use the area of the coast near the two landings would have less capacity to adapt—*i.e.*, fish or boat elsewhere for the duration of the impact—and therefore are considered medium sensitivity. However, impacts will be temporary and limited to a small buffer area around the installation. Fishing is not allowed in the Mombasa MNP, including in the vicinity of the Mombasa North (Shanzu Beach) landing.
In-Built Mitigation	• Kenya Maritime Authority will be given 1 month notice ahead of all installation activities, so that formal maritime notifications can be published. • Early engagement and communication will take place with local ports authorities, naval command, touristic boat companies and fishermen in the area (local BMUs), including discussion of avoidance, management and mitigation measures to limit impacts on local sea users. • Engagement with the State Department of Fisheries will take place to further define avoidance and mitigation requirements as necessary.	
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Minor	Medium	**Minor**
Additional Mitigation	None planned at this time		

10.1.1.2 Introduction of Invasive Non-Native Species

Impact Description

Invasive non-native species (INNS) are those that they threaten biological diversity if introduced and/or spread to areas outside of their natural past or present distribution. These species can also modify ecosystems by introducing disease and pathogens to the environment, leading to mortality of native species. INNS may be bacteria, microbes, plankton, small invertebrates, eggs, cysts and larvae of various species, as well as adult animals. The introduction and spread of INNS can lead to the displacement of native species, modifications to habitats, changes to community structure, interruption of food-web dynamics and the loss of native genotypes (Katsanevakis *et al.* 2014).

The following activities have the potential to introduce INNS into the Project area:

- Vessels: Project vessels from other regions can introduce INNS to the Project area through biofouling, the exchange of ballast water and—to a lesser extent—other sources of discharge such as bilge waters. The potential also exists to introduce INNS that inhabit the hull of a vessel.
- Marine equipment. INNS can be introduced on marine equipment that has been imported from outside the Project area.

During the installation phase, the most likely pathway for transmission of INNS is by marine vessels and equipment that have come from other regions. In the case of the Project, this would be limited to two vessels—the cable-lay vessel and a shore-end barge—as well as the sea plough, ROV, and grapnels. All vessels and equipment will be cleaned and maintained in between system landings in compliance with international conventions on biofouling and invasive species management. Considering the regulatory and best practice mitigation safeguards built into the design of the Project, the likelihood of INNS introduction resulting from Project operations is assessed as remote.

This is a negative, direct impact of medium to long-term duration, if the INNS become established. The impact has a local scale, but this can become a regional issue if in-built mitigation is not applied. The impact is not unique to this Project, but rather a possible impact from any vessel traversing the Kenyan territorial sea and the EEZ from other waters.

With in-built mitigation, including management of ballast waters in accordance with international conventions and industry best-practice, the significance of impact is expected to be **minor.**

Assessment:

Receptors	**Physical**	N/A
	Biological	**Intertidal and Benthic Ecology, Fish and Shellfish, Marine Mammals, Marine Turtles, Protected Areas and Species:** The exchange of ballast water may introduce INNS, which could ultimately lead to competition with native species, and alteration of the marine ecosystem structure and species composition for flora and fauna.
	Human	**Biosecurity**: The INNS may pose a risk to health and availability of marine resources typically used or consumed by humans.
In-Built Mitigation	• All international Project vessels will comply with the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention), and the control and management of ships' biofouling to minimise the transfer of invasive aquatic species (2011 IMO Biofouling Guidelines, 2011). • Project equipment such as the plough, ROV, and grapnels will be cleaned between landings in compliance with the 2011 IMO guidelines above. • Ballast waters will be managed in accordance with the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (BWM Convention, IMO 2017).	
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Minor	Medium	**Minor**
Additional Mitigation	None required		

10.1.1.3 Discharge and Emissions from Vessels

Impact Description

There are three types of routine vessel discharge that could have an adverse effect on water quality:

- black water (sewage, potentially containing harmful micro-organisms, nutrient, suspended solids or organic matter);
- grey water (from showers, sinks, laundry and dishwater including grounded food waste); and
- deck drainage and bilge water potentially contaminated with oil and lubricants.

This is a negative, direct impact and will have a short duration. The impact is reversable and of a local scale if appropriate in-built mitigation measures are in place. With the implementation of the MARPOL safeguards and discharge restrictions, the significance of potential impacts to water quality and marine receptors is assessed to be **minor**.

In addition to vessel discharge, vessels may also produce emissions to the atmosphere during Project operations. These will include emissions associated with the operation of the cable ship and other supporting vessels for the duration of the Project activities. Vessel use may contribute to carbon dioxide (CO_2) particulate matter, sulphur dioxide and oxides of nitrogen (NOx), all of which have the potential to negatively impact the surrounding air quality. Emissions of CO_2 and, to a lesser extent, nitrous oxide and methane contribute to global greenhouse gas (GHG) emissions and ultimately to climate change. Air emissions from the cable-lay vessel will take place from 15 m water depth seaward as the ship installs the cable through EEZ. The vessel will be in compliance with MARPOL 73/78 Annex VI on air pollution; and with the NOx Technical code (2008) Guidelines for Implementation, 2017 edition (IMO 2017). Emissions will therefore be similar to or lower than emissions from other large vessels traversing

the EEZ and entering the Port of Mombasa. The vessel will not remain in one place for an extended duration. Emissions from terrestrial equipment are discussed in Section 10.4.5.

Vessel emissions will have negative, direct impacts on air quality. These impacts will be temporary and local in scale. With in-built mitigation, impacts will be **minor** in significance.

Assessment:

Receptors	**Physical**	**Water Quality:** Water quality is of high importance to the local and regional marine ecosystem, and adverse changes to water quality can impact health and habitat. **Air Quality:** Vessel emissions such as diesel fumes may have an adverse effect on air quality.	
	Biological	**Protected Areas and Species:** Discharges can harm marine environments that are sensitive or have poor mixing and dilution potential. No vessel discharge will take place in protected areas or in the vicinity of coral or other shallow-water species.	
	Human	**Recreation and Tourism and Human Health**: No marine vessel discharges will occur within 12 nautical miles of land. Air emissions from the cable ship will be limited in duration and occur from 15 m water depth seaward. Air emissions can be transported landward towards human receptors. Emissions will be managed through the compliance and mitigation measures outlined below.	
In-Built Mitigation	• All vessels wastes will be managed in accordance with the requirements set out in the International Convention for the prevention of pollution from ships (MARPOL), specifically Annex I, which covers prevention of pollution by oil and oily water; Annex IV, covering prevention of pollution by sewage; and Annex V, which sets out regulations for the prevention of pollution by garbage. o For example, MARPOL requires that untreated sewage may only be discharged at a distance of more than 12 nautical miles from the nearest land, provided that sewage held in holding tanks is not discharged instantaneously, but at a moderate rate when the ship is en route and proceeding at a speed of not less than 4 knots. o By complying with MARPOL, discharge from vessels likewise will not take place in the Mombasa MNP or the Mombasa MNR. • All vessels will comply with MARPOL 73/78 Annex VI on air pollution; and with the NOx Technical code (2008) Guidelines for Implementation, 2017 edition (IMO, 2017). • Vessel fuels will comply with International Maritime Organisation/MARPOL specifications with a sulphur limit of 3.5 percent, and no ozone-depleting substances shall be used. On this basis, vessel emissions will be kept as low as reasonably practicable.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Minor	Low	**Minor**
Additional Mitigation	None required		

10.1.1.4 Underwater Noise and Disturbance

Impact Description

Sound can be either impulsive, such as that produced by seismic arrays and some geophysical survey equipment; or non-impulsive, such as vessel movement. Motorised vessels produce a non-impulsive or continuous sound.

Project vessels that may generate underwater sound in the Kenyan territorial sea and the EEZ may include the following:

- A cable-lay vessel or ‘cable ship,’ measuring approximately 140 m in length and operating at 0.3 to 4 knots during installation (maximum speed is 13.9 knots during transits), will be used to install the cable in deeper waters. The vessel will also maintain position using DP in lieu of anchoring during the shore-end landing.
- A cable-lay vessel or similar vessel will be used for pre-lay clearance activities and post-lay inspection and burial, if needed.
- Divers will use small workboats out to areas of approximately 15 m water depth to more precisely surface-lay cable in shallower waters, connecting the cable to the BMH and installing cable protection and clamps where needed.

The anticipated sound intensity of each vessel type has been based on sound source level (SSL) estimates for different vessel sizes provided by Prideaux (2017) and presented Table 10-1. The cable ship is classified as a large vessel (>100 m) by Prideaux (2017) and is estimated to generate an SSL of approximately 180 to 190 decibels (dB) referenced to 1 microPascal (µPa) at 1 m root mean square (rms) at a few hundred hertz (Hz). Large vessels can also generate sound through propeller cavitation (*i.e.*, the formation and implosion of water vapour cavities caused by the changes in pressure as water moves across a propeller blade), consisting of high-frequency sound levels of 150 dB re 1 µPa at 1 m $_{rms}$; or at broadband frequencies of 0.354 to 44.8 kilohertz (kHz) in water at 700 m distance (rms) of 136 dB re 1 µPa at >700 m $_{rms}$ (Prideaux 2017). All vessels associated with the Project will be operating at slow speeds, which will reduce propeller cavitation. The lengths of the other vessels are unknown but are likely to be classified as either small (<50 m) or medium vessels.

Table 10-1: Sound source levels for proposed sound-generating activities

Installation Activity	Frequency	Sound Source Level (SPL) (dB re 1 µPa at 1 m)	Reference
Continuous Sound Sources			
Small vessels (<50 m)	10 Hz to 20 kHz	160 to 180 (rms)	Prideaux 2017
Medium vessels (50 to 100 m)	<1 kHz	165 to 180 (rms)	Prideaux 2017
Large vessels (>100 m)	<1 kHz	180 to 190 (rms)	Prideaux 2017

Notes:

dB = decibels
Hz =hertz
kHz =kilohertz
m =metres
rms =root mean square
µPa =microPascal
SPL = sound pressure level

Potential effects on marine ecological receptors, ranging from injury to minor behavioural responses, are commonly associated with anthropogenic underwater sound, depending on sound level, frequency and temporal characteristics relative to animal hearing sensitivities. The most likely impacts from vessel movements are behavioural disturbance, although auditory damage, either permanent or temporary may also occur. Vessels and faunal receptors such as fish, turtles and marine mammals are unlikely to be stationary, meaning long-term exposure is unlikely. The offshore area near Mombasa is subject to high baseline levels of ship activity, including fishing, recreational and cargo vessels accessing the port (Section 8.3.6). Therefore, it is reasonable to expect that marine species in this area have adapted somewhat to the presence of underwater noise from ship traffic. Project vessels will be travelling at slower speeds and therefore producing less sound than most other ship traffic in the area.

Fish: Because the movement of vessels produces a non-impulsive or continuous sound, even for fish with high hearing sensitivity that are very close to the sound-generating activity, the risk of injury and mortality is low (Popper *et al.* 2014).

Popper, *et al.* (2014) provide the acoustic sensitivity thresholds for fish groups. Where a quantitative threshold is not available (due to a lack of evidence and high levels of intra and inter-species variability in response), the impact criteria are provided in terms of relative risk (high, moderate, low) for fish at three distances from the source, defined in relative terms as near (N), intermediate (I) and far (F). Whilst specific distances cannot be given for these relative terms, ‘near’ can be considered to be in the tens of metres from the source, ‘intermediate’ in the hundreds of metres, and ‘far’ in the thousands of metres.

The only quantitative thresholds for continuous sound impact in fish are for recoverable injury and temporary threshold shift (TTS), and apply only to high hearing sensitivity fish (Table 10-2):

- For recoverable injury, the threshold is 170 dB sound pressure level $(SPL)_{rms}$ for a continuous period of 48 hours.
- For TTS, the threshold is 158 dB SPL_{rms} for a period of 12 hours.

Table 10-2: Marine fauna sensitivity thresholds for non-impulsive sound sources

Sensitivity Group	Mortality/Mortal Injury	Recoverable Injury	Temporary Threshold Shift	Behaviour
Low-sensitivity fish	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Moderate (F) Low
Medium-sensitivity fish	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Moderate (F) Low
High-sensitivity fish	(N) Low (I) Low (F) Low	170 dB SPL_{rms} (unweighted) re. 1 µPa, for 48 hours	150 dB SPL_{rms} (unweighted) re. 1 µPa, for 12 hours	(N) High (I) Moderate (F) Low
Eggs and larvae	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Moderate (F) Low
Turtles	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low

Source: Popper et al. *2014*

Notes:
dB = decibel
µPa = microPascal
rms = root mean square
SPL = sound pressure level

Highly mobile fish species are likely to show avoidance of the impact zone during vessel movements. Small reef fish are less likely to leave their habitat, due to the protection it provides from predators, and so may have little motivation to move away from any sound sources. An extensive study at Scott Reef in Australia (McCauley 2011) observed behavioural responses that were short-lived and resulted in no long-term changes to fish abundance or diversity.

Fish are expected to display some behavioural responses to sound generated from vessel movements, although these will be very localised and short term. Furthermore, most fish species can either move away or reorient themselves within their habitat range.

Turtles: There is very little information on the impacts of underwater sound on turtles, and there are few studies on the biological significance of hearing for turtles, although they are known to detect and respond to acoustic stimuli (Bartol and Ketten 2006; Lavender *et al.* 2014). Turtles have been shown to detect and respond to underwater low-frequency acoustic stimuli, which for green turtles ranged from 50 to 1,600 Hz, showing their maximum sensitivity to frequencies of between 200 and 400 Hz (Piniak *et al.* 2016). Loggerhead turtle hearing was shown to range between 50 and 1,500 Hz in a study by Lavender *et al.* (2012).

There is no direct evidence that continuous sound may cause injury to turtles (Popper *et al.* 2014). Therefore, the risk of injury to turtles as a result of underwater sound produced by vessel movements is considered to be negligible.

However, noise from vessel movements may result in behavioural responses in turtles. The underwater sound impact thresholds for turtles, indicate that there is a high risk of behavioural response when turtles are close (within tens of metres) to a continuous sound, and a moderate risk at intermediate distances (hundreds of metres). Thus, any avoidance or other behavioural responses by turtles are only likely to occur close to the vessel.

Marine mammals: Marine mammals are known to use sound for a range of biological and social activities. It is an important tool for communicating with other individuals, as well as for echolocation and identification of prey. This is especially true for toothed whales (Odontocetes), who use echolocation as their primary sensory modality. As a group, cetaceans produce and receive sound over a wide range of frequencies from <10 Hz to 180 kHz.

According to OSPAR, there are “no clear indications that underwater noise caused by the installation of sub-sea cables poses a high risk of harming marine fauna” (OSPAR Commission 2009). Permanent and temporary auditory injury to any marine fauna receptor present in the Project area is considered to be unlikely. There may be some behavioural responses, including moving away from the vessel sound source, but the vessel moves slowly; responses are likely to be of minor intensity and were assessed as of slight magnitude.

Cable ship movements are considered unlikely to generate sufficient SSLs to result in permanent threshold shift or other injurious effects in fish, turtles and marine mammals. Potential for TTS is considered likely only in very close proximity (Todd *et al.* 2015).

The impact of noise or sound disturbance is a negative direct impact of short duration. The impact is considered temporary and reversible because the vessels will only be in the area temporarily, most marine fauna will be able to move away from the vessel, and research indicates that sound source sensitivity tends to be low and of a local scale. The significance of this impact is therefore assessed as **minor.**

Assessment:

Receptors	**Physical**	N/A	
	Biological	**Fish and Shellfish, Marine Mammals, Marine Turtles, and Protected Areas and Species:** The movement of marine vessels, and particularly the use of DP, generates underwater sound of a continuous/frequent nature. This can lead to disturbance effects on sensitive marine receptors, although mortality is unlikely, and the risk of injury is low.	
	Human	N/A	

In-Built Mitigation	• Project vessels will travel at slow speeds (between 0.5 and 4.0 knots, depending on installation method), or less (*e.g.*, holding position during the shore-end landing). Reducing ship speed can be a very effective operational measure for reducing underwater noise, especially when it becomes lower than the cavitation inception speed.
	• The cable-lay vessel and shore-end barge will be maintained according to the IMO Guidelines (2014) to reduce underwater noise.
	  ○ Propeller polishing done properly will remove marine fouling and vastly reduce surface roughness, helping to reduce propeller cavitation.
	  ○ Maintaining a smooth underwater hull surface and smooth paintwork may also improve a ship's energy efficiency by reducing the ship's resistance and propeller load. Hence, it will help to reduce underwater noise emanating from the ship.
	  ○ The installation vessels will be equipped with fixed pitch propellers.
	• The Project will abide by the Resolution MSC 337(91) code on noise levels on board ships.
	• The Marine Mammal (and other Megafauna) Protocol will be discussed with and agreed on by all parties prior to installation commencing.		

Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Minor	Medium	**Minor**
Additional Mitigation	None required		

10.1.1.5 Accidental Leaks and Spills

Impact Description

Accidental discharges (oil spills) may occur in the event of a collision or other unanticipated event at sea. Minor hydrocarbon spills may occur as a result of leaking hydraulic hoses, equipment, storage containers or spillages during refuelling. Spill volumes for this kind of event are typically small, consisting of a few litres. The worst-case scenario consists of the highly unlikely event of spillage of the whole fuel inventory of a vessel. The likelihood and impact of a spill associated with the cable vessel would be comparable to that of other large shipping vessels transiting the EEZ on a regular basis.

Given the small number of Project vessels and limited duration of use (survey, installation and repairs), the likelihood of accidental spills is considered remote (*i.e.*, an event of major to moderate significance) to unlikely (*i.e.*, an event of minor to slight significance). This is a negative, direct impact with a regional

scale, because spills can spread into wider areas. Impacts from a spill could be of medium to long-term duration, depending on the scale and materials associated with the spill. With the implementation of in-built mitigation measures, including compliance with MARPOL and best management practices for handling chemicals and fuels on board vessels, the significance of this impact is expected to be **minor.**

Assessment:

Receptors	**Physical**	**Water Quality:** It is anticipated that Project vessels may use marine diesel as fuel. If released into the marine environment, diesel will typically undergo rapid dispersion and evaporation when subjected to wave action, wind, currents and light, as well as degradation via bacterial action. Consequently, any small releases are likely to break up and disperse in a short space of time. Larger spills, however, have the potential to impact water quality, and ultimately the health and habitat of flora and fauna, particularly if the spill is close to the coast and in shallow water.
	Biological	**Intertidal and Benthic Ecology, Fish and Shellfish, Marine Mammals, Marine Turtles, Seabirds, and Protected Areas and Species:** Spills, if unmanaged, can have a toxic effect on marine species and in some cases lead to bioaccumulation and ultimately lethal or sublethal affects. Spilled fuels and oils can also directly impact fish, marine mammals, turtles and seabirds via smothering; this can cause toxicity or inhibition of normal behaviours (*e.g.*, feeding and egg laying) and ultimately lead to mortality. The effect on marine life may include behavioural disturbance such as displacement from affected areas. Oil spills penetrate the structure of the plumage of birds and the fur of mammals, reducing their insulating ability and making them more vulnerable to temperature fluctuations and much less buoyant in the water.
	Human	**Fisheries:** If the spill/leak reaches areas where fishing activities are focussed, fish may avoid the areas or be poisoned by the chemicals in the water.
In-Built Mitigation	• The vessel will comply with MARPOL Annex I – Prevention of Pollution by Oil and will have a contingency plan for marine oil pollution in the form of Shipboard Oil Pollution Emergency Plan. • All vessels will have chemical handling procedures for oils and fuels in place and Health Safety and Environmental monitoring procedures, with weather and personnel limits to be implemented during cable installation. • Kenyan Oil Spill mitigation measures adopted by the Oil Spill Mutual Aid Group (OSMAG) will be adopted for the Project. • KPA and OSMAG will be informed of installation timing in advance of the cable installation. • An Emergency Spill Response Plan and a Waste Management Plan will be implemented as part of onshore construction activities to ensure that appropriate control and response measures are in place.	
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Minor	Medium	**Minor**
Additional Mitigation	None required		

10.1.1.6 Interactions between Vessels and Marine Megafauna

Impact Description

Moving vessels could collide with marine wildlife such as marine mammals and turtles, resulting in physical injuries and in extreme instances mortality. Marine wildlife is most at risk of collision when the vessel traffic is high, the vessels are greater than 80 m in length, and the vessels are travelling at speed faster than 14 knots. Vessel strikes are unlikely during cable installation because Project vessels operate at low speeds and proceed along a predictable path. The movement and sound of the vessel could be detectible to marine mammals and turtles, giving them the opportunity to avoid Project vessels.

Most cetaceans, particularly dolphins and small whales, are agile, possessing quick reflexes, fast swimming abilities and good sensory recognition, making them capable of avoiding most vessels (Hoelzel 2002). However, larger whale species such as humpback whale are at more risk of collision from vessels, particularly with large vessels that may also be slow moving (David *et al.* 2018). Several species of whales and dolphins have been recorded in Kenyan marine waters. Studies have indicated that blue whales are commonly sighted offshore of the fringing reefs of Mombasa and rarely come into inshore waters. Humpback whales migrate north and south along the Kenya coast annually. The Mombasa MNP has been reported to be part of the home range for dolphins (KWS 2016).

Marine mammals distracted by activities such as foraging and social interactions may not perceive the threat of moving vessels and could therefore be vulnerable to vessel strikes (Wilson *et al.* 2007). The

high proportion of calves and juveniles among collision victims suggests that perception of vessels as a threat is something that is learnt later in life (ACCOBAMS 2016). Marine mammals are relatively robust to potential minor strikes because they have a thick subdermal layer of blubber that protects their vital organs from minor strikes or collisions (Wilson *et al.* 2007). However, a direct strike from a sharp object such as a moving propeller blade would have significant potential to cause injury and mortality.

Marine turtles may also be subject to injury or mortality from vessel strikes, although there are fewer such incidences reported for turtles than for marine mammals (Hazel *et al.* 2007). Unlike marine mammals, turtles are not fast or agile, and may not have the ability to avoid vessels travelling faster than 4 km/h (~2 knots). Individuals that occur close to the sea surface to bask, mate or breathe are more vulnerable to vessel collisions or being struck by propellers. Similarly, individuals foraging, nesting or swimming in water depths insufficient to allow the draft of the vessel and propellers to pass over are also vulnerable to impacts (Shimada *et al.* 2017). Given the smaller size of turtles and their hard carapace, the risk of a minor collision and the resulting impact being lethal are both low. However, like marine mammals, turtles are unlikely to withstand a direct strike from a propeller.

The cable-lay vessel will be travelling at extremely slow speeds (0.3 to 4 knots during cable burial and surface lay, respectively). It is considered unlikely that collisions between marine wildlife and this vessel will occur. The other smaller dive boats pose a greater risk due to their capacity to travel at faster speeds in shallow water (< 15 m depth). However, these movement types are expected to be limited in extent (*i.e.*, associated with the shore-end landing activities only), and the increase in the number of vessels that this represents is negligible.

Megafauna tourism (commercial whale and dolphin watching) is concentrated in the central and southern coastal areas of the Malindi Watamu Marine Protected Area and the KMMPA (IWC 2020). The Mombasa MNP and Mombasa MNR where the Project is proposed is not known for megafauna tourism opportunities.

Given the high volume of existing maritime traffic in the vicinity of the proposed cable route, megafauna will likely be deterred from the area and/or accustomed to existing vessel activity. Vessel collision with megafauna, should it occur, is a negative, direct impact with a short duration but (potentially) irreversible effects. With in-built mitigation measures, including slow vessel speeds and application of safety buffers in the event of a turtle or mammal sighting, the significance of this impact is **moderate.** With the additional mitigation detailed below, including implementation of a Marine Megafauna Protocol detailing specific avoidance and response measures, the residual significance of the impact is **minor.**

Assessment:

Receptors	**Physical**	N/A	
	Biological	**Marine Mammals, Marine Turtles, and Protected Areas and Species:** Megafauna may collide with the vessels or avoid the immediate vicinity of Project vessels.	
	Human	N/A	
In-Built Mitigation	• Project vessels will operate at speeds of 4 knots or less while laying and burying cable. • Safety zone separations from sighted marine mammals or turtles will be implemented. More specifically, vessels will temporarily halt operations when sea turtles or marine mammals are spotted within a 90 m buffer.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Low	High	**Moderate**

Additional Mitigation	• A Marine Megafauna Protocol shall be developed and implemented in coordination with KWS; this may include, for example:
	  ○ a response plan in the event of megafauna collision;
	  ○ implementing a safety zone and/or speed restriction on the sighting of pods of whale species, bait balls (*i.e.*, large, tightly packed formations of fish) or slow-moving megafauna such as Whale Sharks; or
	  ○ all designated personnel maintaining a vigilant watch for marine mammals and sea turtles within a designated radius of the vessel and halting operations, as described above.		

10.1.1.7 Use of Anchoring Systems in Shallower Waters

Impact Description

The main-lay vessel will use DP to maintain position, avoiding the need for anchors. However, smaller support boats associated with the shore-end landing and post-installation activities in shallower waters may need to drop anchors while supporting cable installation activities, including within the Mombasa MPA. The PLSE barge will use DP for most activities from 1.2 m water depth but may use pre-installed anchoring points to maintain position in the lagoon. In the absence of best management practices, this activity has the potential to have a negative direct impact on coral habitats in the immediate vicinity of the nearshore cable route. Damage to coral from anchors would be long term, given the slow pace of coral growth. However, with best management practices in place, the likelihood of impacts should be low. Given the small number of boats and relatively short duration of Project activities, this impact is expected to be of short duration and local in scope. Additional coordination with KWS to confirm and adhere to anchoring requirements in the MPAs will further reduce the potential for impacts. With these measures in place, impacts on coral from anchoring systems are expected to be **minor** in significance. Potential impacts on coral reefs and seagrass from other activities associated with the shore-end landings are discussed separately in Section 10.3.2.2.

Assessment:

Receptors	**Physical**	N/A	
	Biological	Coral reefs are sensitive to damage as a result of ship anchors, including scoring, breakage or mortality of the direct impact area.	
	Human	Tourism, recreation and fisheries depend on the health of coral reefs in the nearshore environment.	
In-Built Mitigation	• The PLSE barge will use DP to maintain position for the shore-end landing, thereby avoiding the need for anchoring. The main-lay vessel will likewise use DP during cable lay in deeper waters. • Smaller vessels associated with the shore-end landings will comply with anchoring requirements in the MPA; use established anchoring locations, if available; and avoid anchoring in sensitive habitats (*e.g.*, coral reefs).		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Slight	High	**Minor**
Additional Mitigation	• An anchoring plan will be prepared for installation near coral reefs, in consultation with KWS. This may include, for example, prohibiting anchoring close to sensitive habitats in shallow waters.		

10.1.1.8 Visual Disturbance from the Vessel

Impact Description

The lighting of the vessel can be a disturbance to the seabirds. This is a negative direct impact of short duration (*i.e.*, night-time lighting during marine cable installation in deeper waters). The cable vessel will display night-time operational lighting whilst holding station. Impacts would be similar to those from cargo ships and other large vessels that are common in Kenyan waters. Work in the nearshore area will be limited to daylight hours. The impact will be localised and temporary. With in-built mitigation measures in place, including directional and hooded lighting on board the cable ship, potential impacts are expected to be **negligible.**

Assessment:

Receptors	**Physical**	N/A	
	Biological	**Sea birds:** Increased visual stimuli (including artificial light) from the presence of marine vessels can lead to avoidance behaviour in seabirds, which could affect breading or foraging activities, with potential for wider implications for populations.	
	Human	N/A	
In-Built Mitigation	• Lighting on the cable ship will be directional and hooded/shaded as necessary to reduce unnecessary light spill. • Operations close to the shore will be performed during the day, avoiding lighting disturbance.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Slight	Low	**Negligible**
Additional Mitigation	None required		

10.2 Pre-Installation Works

10.2.1 Route Clearance

Clearance is planned along those sections of the cable route where ploughing is to be performed (*i.e.*, in soft-bottom areas to 1,000 m in depth). To prevent the ploughing operation from being interrupted by old OOS cables known to cross the proposed cable route, the vessel will remove a suitable section of the old cable. The ends of any cut OOS cables will be laid onto the seabed and weighted.

10.2.1.1 Disturbance by Resuspension of Sediment

Impact Description

The activity on the seafloor will cause localised resuspension of sediment in the immediate area of the cut points. This is a negative direct impact of short duration, easily reversable because the sediment should settle back into place, and local in scale in that it will impact only the immediate area of route clearance. The significance of the impact is expected to be **negligible**.

Assessment:

Receptors	**Physical**	**Geology/Intertidal/Seabed Sediments:** Soft sediment will be disturbed and may be resuspended, possibly resettling in nearby locations. **Water Quality:** Sediment in suspension can cause reduced visibility and turbidity.	
	Biological	**Benthic Ecology, Fish and Shellfish:** The resuspension and resettling of sediment may temporarily impact the habitat of these receptors.	
	Human	N/A	
In-Built Mitigation	N/A		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	No effect/slight	Low	**No effect/negligible**
Additional Mitigation	None required		

10.2.1.2 OOS Cable Disposal Onshore

Impact Description

Where old OOS cables are known to cross a section of the proposed cable route and where plough burial is planned, the vessel will remove a suitable section of each old cable during the route clearance operations. Two OOS cable crossings have been identified in Kenyan waters, both along the Mombasa

South (Nyali Beach) branch cable route. Metal components are typically removed for recycling; any remaining cable components may need to be disposed of onshore at suitable waste disposal facilities. Additional waste over and above land-derived waste places greater pressure on the lifespan of these facilities. This is a negative impact of long-term duration (permanent disposal) unless a reuse for the cable sections is found, but the scale of the waste requiring disposal is minimal. This impact is local in scale in that it impacts waste facilities in the immediate area. With in-built mitigation measures in place, including compliance with all national and local regulations for waste disposal, impacts from OOS cable disposal are expected to be **negligible**.

Assessment:

Receptors	**Physical**	N/A	
	Biological	**Terrestrial (beach) habitats:** Debris can be hazardous to terrestrial habitats unless disposed of at appropriate facilities.	
	Human	**Utilities:** Additional waste over and above land-derived waste places greater pressure on the lifespan of waste disposal and landfill facilities. **Public Health and Safety**: Irresponsible dumping can lead to public health and safety impacts (where appropriate facilities are not used).	
In-Built Mitigation	• Metal components of OOS cable sections are typically removed for recycling. • Wastes will be managed in accordance with applicable regulations and industry practice, following protocols and requirements for disposal of wastes, using appropriately licensed facilities and service providers. • OOS cable segments removed during route clearance will be disposed of on completion of the operations in accordance with local regulations. • All waste disposal facilities used will be fully and appropriately licensed, with suitable ESMPs in place for the waste management streams in question.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	No effect/slight	Low	**No effect/negligible**
Additional Mitigation	None required		

10.2.2 Pre-Lay Grapnel Run

PLGR applies to areas in which burial is planned; that is, along the route at depths less than 1,000 m and across sediments suitable for burial. PLGR is not conducted over rocky or hard surfaces. The aim of the PLGR is to clear the seabed surface of all debris that may obstruct the ploughing process. The vessel will move along the route, towing a grapnel or an array of grapnels along the seabed. Typically, the route is run once, except in areas of high fishing or marine activity, where additional runs might be made. The grapnel penetrates 0.5 to 1.0 m into soft sediment.

10.2.2.1 Disturbance by Resuspension of Sediment

The removal of debris (*e.g.*, old fishing nets, rope/wires or anchor chains) on the seabed surface will cause the resuspension of sediment. This is a negative, direct impact but will be of short duration (occurring immediately during the grapnel run activity). The impact is considered easily reversable because the sediment naturally settles back into its original location following the grapnel run. It is local in scale in that it will impact the immediate environment where the activity is taking place, with a small possibility of the sediment drifting from the immediate site into the surrounding area. Sediment disturbance from the PLGR is therefore expected to be **minor** in significance.

Assessment:

Receptors	**Physical**	**Geology/Intertidal/Seabed Sediments:** Debris/sediment will be disturbed and may be resuspended, possibly resettling in nearby locations. **Water Quality:** Sediment in suspension can cause reduce visibility and turbidity.	
	Biological	**Benthic Ecology, Fish and Shellfish:** The resuspension and resettling of sediment may temporarily impact the habitat of these receptors.	
	Human	N/A	
In-Built Mitigation	The duration of the activity will be kept as short as possible.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Minor	Low	**Minor**
Additional Mitigation	None required		

10.2.2.2 Debris Disposal Onshore

Impact Description

The debris (*e.g.*, old fishing nets, rope/wires or anchor chains) recovered during the PLGR will need to be disposed of onshore at suitable waste disposal facilities. Additional waste over and above land-derived waste places greater pressure on the lifespan of these facilities. However, removal of debris from the ocean floor can also have positive effects for the marine environment, including reducing the risk of entanglement for fishing gear and marine species. Onshore disposal is a negative impact of long-term duration (permanent disposal). The impact is considered irreversible unless a reuse for the debris is found, but the scale of the waste requiring disposal is minimal. This impact is local in scale in that it impacts the immediate waste facility in question. With in-built mitigation measures in place, including compliance with all national and local regulations for waste disposal, impacts from debris disposal are expected to be **negligible**.

Assessment:

Receptors	**Physical**	N/A	
	Biological	**Terrestrial (beach) Habitats:** Debris can be hazardous to terrestrial habitats unless disposed of at appropriate facilities.	
	Human	**Utilities:** Additional waste over and above anticipated (typically land-derived) waste streams places greater pressure on the lifespan of waste disposal and landfill facilities. **Public Health and Safety**: Irresponsible dumping can lead to public health and safety impacts (where appropriate facilities are not used).	
In-Built Mitigation	• Wastes will be managed in accordance with applicable regulations and industry practice, following protocols and requirements for disposal of wastes, using appropriately licensed facilities and service providers. • Debris recovered during these operations will be discharged ashore on completion of the operations and disposed of in accordance with local regulations. • All onshore yards and disposal sites used will be fully and appropriately licensed, with suitable ESMPs in place for the waste management streams that will be required.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	No effect/slight	Low	**No effect/negligible**
Additional Mitigation	None required		

10.3 Cable-Lay Activities

10.3.1 Offshore Cable Installation

The cable will be 'surface laid' in water depths greater than 1,000 m. In water depths of up to 1,000 m, the cable will be buried up to 2 m below the seabed in soft-bottom areas to protect it from threats such as anchoring, trawl fishing and other maritime activities. This section discusses potential impacts associated with these activities; potential impacts associated with the cable installation in nearshore waters is assessed in Section 10.3.2.

10.3.1.1 Benthic Habitat Disturbance

Impact Description

The installation of the cable on the seafloor may cause localised resuspension of sediment during placement and burial activities, impacting benthic habitat.

The approximate locations of offshore burial and surface lay for the two cable branches in Kenyan waters are provided in Figure 3-18. In waters deeper than 15 m, approximately 82 km of the Mombasa North (Shanzu Beach) cable branch will be buried by plough; approximately 81 km will be surface laid in deeper waters through the Kenyan EEZ. In waters deeper than 15 m, approximately 64 km of the Mombasa South (Nyali Beach) cable branch will be buried by plough; the remaining 42 km in the EEZ will be surface laid. The surface-lay process will result in negligible resuspension of soft sediments (*e.g.*, sand veneer on hard-bottom or deep-water soft sediments). Burial activities may result in limited resuspension of sediment as the 20 cm plough passes through soft sediments and lays the cable in a narrow furrow (approximately 1 m wide). Sediments will typically settle back into the furrow as the plough passes, filling the furrow and burying the cable.

The upper layer of soft-bottom sediment and the habitats and species in this layer may be displaced or smothered by cable placement and burial. However, the organisms that inhabit this layer are accustomed to the dynamic conditions of soft-bottom habitats, and the populations tend to be resilient. The area disturbed by cable installation would be small relative to available habitat, and species in the soft-bottom habitats are expected to repopulate rapidly.

Sediment disturbance and increased turbidity is a negative, direct impact but will be of short duration (occurring immediately during the cable-lay activity). The impact is considered easily reversable because the sediment should settle close to its original location; and local in scale in that it will impact the immediate environment where the activity is taking place, with a small possibility of the sediment drifting from the immediate site into the surrounding area. With in-built mitigation measures in place, the significance of this impact is expected to be **minor.**

Assessment:

Receptors	**Physical**	**Water Quality:** Sediment in suspension can cause temporary and localised reductions in visibility and increased turbidity. The areas where plough burial is planned, both along the northern and southern cable branch routes, are in the vicinity of river mouths, where some level of sediment discharge and turbidity is common.	
	Biological	**Benthic Ecology, Fish and Shellfish:** Plough burial will only be undertaken in waters deeper than 15 m in soft-bottom substrates. The resuspension and resettling of sediment may temporarily impact the habitat of these receptors and may clog filter-feeders. Species in the affected sediment layers tend to be accustomed to temporary disturbance and dynamic conditions and repopulate rapidly.	
	Human	N/A	
In-Built Mitigation	• The route survey allows for selection of seabed that provides good conditions for burial. • Sea-ploughs used for subsea cable burial have been optimised by the industry to limit physical impacts to a narrow furrow (approximately 1 m wide by up to 2 m deep), plus the impact of the sled 'skis' as they cross the seabed.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Minor	Low	**Minor**
Additional Mitigation	None required		

10.3.2 Nearshore Cable Installation

Installation of the cable in shallow waters (up to 15 m water depth) will require divers and small boats to support the cable-landing operation, including floating the cable and then positioning it on seabed. The cable will be surface-laid in hard-bottom areas and buried in soft sediments via diver jetting.

10.3.2.1 Benthic Habitat Disturbance

Impact Description

In shallow waters, the cable will be diver-laid on the seabed and either secured to hard-bottom substrates (only done in high-energy surf zones) or subsequently buried in soft sediments via diver jetting. Jetting is used in inshore areas where sediment tends to move easily and regularly with the ebb and flow of tides (*i.e.*, resuspension of sediment is common). This activity could temporarily result in the physical disturbance of the seabed habitat and in some instances physical damage of less mobile fish receptors present in the surface sediment (eggs, larvae and shellfish). Placement of the cable in hard-bottom areas could likewise result in localised temporary disturbance of benthic habitat and associated sessile communities. Divers will place the cable to avoid rocks, boulders and corals. The use of divers enables the Project to place and secure the cable directly on the seabed and avoid any suspensions. This protects the cable and helps to avoid impacts to coral habitat. Further discussion of coral habitat is provided in Section 8.2.2.1.

The sensitivity of this receptor varies because some mobile species have greater capacity to accommodate such changes through movement to undisturbed areas, while sessile or less mobile species are considered less tolerant. Demersal species and demersal life stages (*e.g.*, eggs, larvae or juveniles) are considered to be most sensitive to effects from physical disturbance to and/or temporary loss of seabed habitat. Effects on these receptors are likely to include:

- temporary disturbance to and/or loss of specific functional habitats (*e.g.*, spawning grounds and suitable habitat); and
- physical damage to eggs, juveniles and adults.

Impacts to benthic habitat will be temporary and local in scale. Once the cable is installed on or under the seabed, it does not disturb marine species or habitat. Application of articulated pipe adds weight to the cable, helping to prevent the cable from moving once installed and can even provide a substrate for organisms to grow on in the future. Loss of benthic habitat is a negative, direct impact of short-term duration. It is anticipated that benthic species will adapt and recover on and around the cable. The impact is local in scale. With in-built mitigation measures, including detailed routing efforts and use of diver jetting in shallow waters, benthic habitat disturbance is expected to be **minor** in significance.

Assessment:

Receptors	**Physical**	**Geology/Intertidal/Seabed Sediments:** Sediment will be disturbed and may be resuspended, possibly resettling in nearby locations. This may smother the seabed and could result in a change in seabed geomorphology, sediment structure and habitat. **Water Quality:** Sediment in suspension can cause reduced visibility and increased turbidity.	
	Biological	**Intertidal and Benthic Ecology, Fish and Shellfish:** The resuspension and resettling of sediment may temporarily impact the habitat of these receptors.	
	Human	N/A	
In-Built Mitigation	• The geophysical route survey was undertaken to determine the optimum alignment of the cable that would avoid hard structures such as corals and other high-value ecological receptor wherever possible. • Use of diver-jetting in shallow waters and/or near sensitive receptors will help to minimise impacts during burial.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Minor	Low to medium	**Minor**
Additional Mitigation	N/A		

10.3.2.2 Impacts on Coral and Seagrass Habitat

Impact Description:

Starting from the HWM seaward in the Mombasa MNP, the North Mombasa (Shanzu Beach) cable route crosses an area of dense seagrass. It then transitions first into seagrass interspersed with sandy bottom, and then a section of hard substrate mainly covered by macroalgae and a few scattered coral heads (*Porites*) (WRTI and KWS 2021). The South Mombasa (Nyali Beach) cable route crosses a lagoon characterised by dense seagrass and then crosses the Nyali coral garden, which includes hard-bottom substrate dominated by macroalgae and rubble, with low coral cover (<10 percent) (WRTI and KWS 2021).

During the route planning phase, the route survey identified a proposed cable route that avoided coral areas wherever feasible (for example, targeting breaks in the reef), both for cable protection and to minimise environmental impacts. Where coral areas could not be avoided entirely (*i.e.*, in the nearshore approaches to the two landings), the use of divers to hand-lay the cable will enable the Project to make micro-adjustments to the route during installation and avoid most or all impacts on living coral. A pre-swim of the route will be conducted prior to the landing to identify sensitive areas and finalize the route, including avoidance of coral. The cable itself is relatively flexible and can be routed around boulders and reefs to lay on the seabed.

Diver-led installation also enables the Project to avoid suspensions. The tension and weight of the cable, at > 6 kg per metre, helps to maintain the cable in position on the seabed except in extremely high-energy environments (> 4 knot perpendicular current). Surface current speed in the range of 0.1 to 2.5 knots in north-westerly and south-easterly directions were observed during cable route survey operations along the two branch cable routes in Kenya. However, currents could be stronger at the river mouths during the monsoon seasons (March to May and a shorter season in October). This will be considered in the decision on the need for additional cable security (*e.g.*, cable clamps) on the seabed at the time of installation. The cable will be protected with articulated pipe along the first 843 m of the nearshore route, adding additional weight and further preventing movement (and any associated damage to coral) once the cable is installed. However, articulated pipe is not planned through the reef gap at this time.

Some temporary disturbance may occur during installation as sediment is stirred up by placement of the cable and other human activity, but direct impacts on live coral should be minimal. Seagrass will be impacted where it is growing within the direct cable footprint (approximately 130 mm, with articulated pipe applied) and in the vicinity of diver-jetting. The impact footprint will be small relative to the size of the seagrass beds in the Mombasa MNR. Once the cable is installed, seagrass is expected to recover and repopulate the area impacted during installation. Seagrass tends to be fast-growing and resilient to temporary disturbance in the nearshore environment. Potential impacts on sensitive species from vessel anchoring is discussed separately in Section 10.1.1.7.

Given the very small spatial scale of both permanent loss and temporary disturbance, this effect would not be expected to compromise the functional integrity of these habitats and species or diminish biodiversity at the regional level.

Loss of coral habitat is a negative, direct impact of long-term duration, whereas impacts on seagrass will be negative, direct impacts of short-term duration. The impact will be local in scale (footprint and immediate surroundings) and it is anticipated that marine habitat will adapt and recover on and around the cable. Once in place and with articulated pipe applied, the cable does not typically move on the seabed. With in-built mitigation in place, including use of divers to hand-lay the cable around corals and sensitive habitats where feasible, impacts from the cable installation will be minor in magnitude. However, given the high sensitivity and slow recovery rate of coral species in particular, impacts are assessed as **moderate** in significance. Additional mitigation measures include coordination with KWS during the pre-installation dive to micro-site the cable position in relation to coral reefs in the reserve, as well as adherence to sea-state conditions and tidal conditions (*i.e.,* water levels at the reef) agreed on with KWS. With these measures in place, residual impacts on sensitive habitats resulting from the nearshore cable installation are expected to be **minor**.

Assessment:

Receptors	**Physical**	N/A	
	Biological	**Coral habitats:** Disturbance to these important habitats in the direct footprint of the cable, where the cable-laying activities break, smother or scrape the living coral. Coral cover and health are generally low in the vicinity of the Nyali Beach cable route and higher in the vicinity of the Shanzu Beach route, particularly in the Mombasa MNP. **Seagrass habitats:** Temporary disturbance to these important habitats may result from the cable-laying activities at both landings. Seagrass tends to be fast-growing and resilient to temporary disturbance in the nearshore environment.	
	Human	**Fisheries and Tourism:** Fisheries and tourism activities depend heavily on the presence of coral reefs, seagrass and the species these habitats represent.	
In-Built Mitigation	• Use of divers to hand-lay the cable will enable the Project to avoid most impacts on living coral. • Use of diver jetting will help to reduce the impact on surrounding habitats from sediment disturbance during burial of the cable in soft-bottom substrates. • The tension and weight of the cable, at > 6 kg per metre, helps to maintain the cable in position on the seabed except in extremely high-energy environments (> 4 knot perpendicular current). • If the cable engineers determine that cable movement is likely, clamps will be applied to further secure the cable to the seabed.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Minor	High	**Moderate**
Additional Mitigation	• The cable installer will coordinate with KWS in advance of and during the pre-lay swim, to refine the cable alignment within the Mombasa MNR. • Cable installation in the vicinity of coral habitat will take place within appropriate sea-state and tidal conditions (*i.e.,* water level at the reef); to be defined in consultation with KWS.		

10.4 Cable Landing

The cable landings in Kenya will be installed using the PLSE method from water depths of approximately 15 m. As described in more detail in Section 3.3.3.4, the cable will be floated from a shore-end vessel and lowered to the seabed by divers. The beach burial will extend from the water line to the BMH or end of seaward ducts. The submarine cable will normally be buried to a depth of 2 m below surface or to hard ground. Where feasible, the cable will be buried by diver-jetting in the nearshore area during PLIB. Installation and burial of the earth plate and earth cable will also take place on the beach, typically close to the day of the landing.

10.4.1 Disturbance to Terrestrial Habitat and Species

Impact Description

The beaches at both cable-landing locations are heavily used by people, and in some areas have existing infrastructure and other forms of anthropogenic disturbance. Nevertheless, three endangered species of marine turtles (green turtle, loggerhead turtle and olive ridley) are known to nest on Nyali Beach and Shanzu Beach at the edge of the highest tide zones. Turtle nesting in Kenya occurs year-round. Data from 2021 indicate at least some level of nesting activity at both Nyali and Shanzu Beaches every month, with the most nests (six) observed in March and April at Shanzu Beach (WRTI and KWS 2021).

Activities associated with the earth system installation, trenching and cable pull to the BMH may result in temporary disturbances to turtles attempting to nest; or interfere with hatchlings moving toward the water. Installation of the cable on the beach will require excavation of a trench 2 m deep by approximately 6 m wide (to safely reach this depth), depending on sediment properties. The beach is typically restored within 1 to 2 days. The cable landing is completed within a single day. Construction of the earth system likewise requires one day per landing site.

Cable-landing operations will be temporary and have a relatively small disturbance footprint (approximately 2 m depth and 6 m in width from the waterline to the BMH). Installation activities will occur during daylight hours and therefore avoid the need for night-time lighting that could affect turtle nesting activity. Noise disturbance associated with the cable landing is not expected to greatly exceed the existing ambient anthropogenic sounds of tourism and beach activity and will adhere to all national and local regulations.

Prior to mitigation, the impact would be a negative, direct impact, ranging from temporary (*i.e.*, avoidance of the area for nesting during installation) to permanent (in the unlikely event that a turtle nest is directly impacted by construction activities). With in-built mitigation, impacts on beach habitat will be restricted to a narrow area and short time period, reducing the likelihood and magnitude of impact. However, given the sensitivity of the species in question, potential impacts are assessed as **moderate** prior to additional mitigation. With additional mitigation (*i.e.,* turtle nest monitoring in advance of and during beach work), impacts on nesting turtles will be avoided, and the residual impact/nuisance to terrestrial species would be **minor**.

Assessment:

Receptors	**Physical**	N/A	
	Biological	**Marine Turtles**: Increased beach activity during the installation has the potential to disturb turtles attempting to nest on the beach; trenching and cable installation could impact existing nests or hatchlings.	
	Human	N/A	
In-Built Mitigation	• Installation activities will occur in daylight hours; therefore, beach lighting at night will not be required. If night lighting is required for public safety, the lighting can be shielded and/or directed away from the beach. • The beach trench will be limited to as narrow a corridor as is safe and technically feasible. • Soil and aggregates will be stored away from any drainage areas during onshore trenching. • The beach will be restored to its original condition; the trench will be backfilled to its original contour with the original material. • The beach will be restored as quickly as technically feasible following installation of the cable. • The Project will abide by the EMCA noise and vibration regulations during onshore activities.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Minor	Very High	**Moderate**
Additional Mitigation	• Turtle nest monitoring will be conducted within the Project footprint prior to installation to check for turtle nests and recent turtle activity. The timing (*i.e.*, days in advance of beach works) and details of turtle monitoring will be coordinated with KWS to meet Kenyan requirements. If active nests and/or nesting attempts are observed by monitors, appropriate mitigation measures—for example, temporary fencing and monitoring during beach works—to avoid nest disturbance will be taken by the Project in consultation with KWS.		

10.4.2 Beach Parking and Access Constraints

Impact Description

The proposed locations for the BMHs for both landing sites are in the public access roads to Shanzu and Nyali Beaches. Installation of a BMH and associated infrastructure typically requires approximately 3 days to complete. Public beach access may be constrained or temporarily restricted during this time, and available parking bays may be limited. The BMH installation for the Mombasa North (Shanzu Beach) cable may result in the temporary closure of the access road, given that the access road is quite narrow. Vendors and tour operators could lose revenue during this period if beach access cannot be maintained. On Nyali Beach, vendors are located where the access road meets the beach (Figure 10-2). During the cable landing, foot traffic may increase at both sites (*i.e.*, people interested in watching the landings), resulting in a minor positive impact for vendors that should offset some of the effects of access constraints during other construction activities. Procurement of local goods and services by the Project—including lodging, restaurants and supplies—will also provide an offsetting temporary benefit to local hotels and vendors.

This is a negative direct impact but will be of short duration (occurring immediately during installation activities) and at a local scale. The impact is considered reversable because the constructed area will be reinstated to a condition similar to or better than its condition prior to construction, including its original access/parking function. One month's notice will be given in advance of the shore-end landing activities. As additional mitigation, 2 weeks' notice will be provided for the BMH installation, with the construction scheduled to avoid peak use if possible. With these measures in place, residual impacts are expected to be **minor** in significance.

Assessment:

Receptors	**Physical**	N/A
	Biological	N/A
	Human	**Recreation and Tourism:** Beach users, vendors, tour operators and fishermen could be affected by reduced access. Some of these groups would be vulnerable to fluctuations in income and may not have an alternative location to set up their business.
In-Built Mitigation	• The extent and duration of road closures or parking impacts will be limited to the greatest extent practicable, avoiding closure of the road if possible.	
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Medium	Medium	**Moderate**
Additional Mitigation	• A 2-week notice period will be provided to surrounding businesses, traders and hotels, alerting them to the planned duration and schedule of installation work. The local community and beach users will be informed of the planned installation activities through local radio stations, newspaper adverts, public notices or other similar means. • The BMH installation activities will be scheduled to avoid peak holiday periods, if possible.	

10.4.3 Access Restrictions for Local Fishermen

Impact Description

The Earth System installation, trenching and cable pull to the BMH may result in temporary disruptions to local coastal tourism and fisheries in the immediate vicinity of the cable installation. Marine users will have to avoid the immediate corridor around the cable route during the shore-end landing and post-installation activity (articulate pipe application, clamping and burial).

Installation operations on the beach and in the water may cause some localised interruption to local fishing activities. All areas will be restored to their pre-installation condition at the conclusion of the installation.

During the stakeholder consultation process, concerns were raised regarding potential impacts on fishing areas and landing sites. The Project team asked the BMU and fishermen to identify the landing site locations on a map. The following information was provided.

Fish landing sites:

- Mombasa North (Shanzu Beach): Fish landing sites in this area are in the creek north of the beach, not on the beach itself. Therefore, Project activities will not affect the fish landing sites. Furthermore, the area immediately off the beach is in the Mombasa MNR and Mombasa MNP, where fishing activities are banned by law for conservation and reef protection; therefore, fishermen are not allowed to land their fish on this beach (Figure 10-1).
- Mombasa South (Nyali Beach): There are two fish landing sites on Nyali Beach, one to the north and one to the south of the proposed cable-landing site and BMH (Figure 10-2).

Fishing areas: The following fishing areas were indicated by stakeholders during the engagement process:

- Mombasa North (Shanzu Beach): Fishing is not allowed in the area immediately offshore of the landing within the boundaries of the Mombasa MNR and Mombasa MNP. Therefore, the Project will not have an impact on fishing activities in shallow waters, and there are no fish landing sites near the landing. In waters outside of the Mombasa MNR, there may be temporary disruption to fishing activities during the installation. Given the large area in question, there should be sufficient space for fishermen to undertake their usual activities away from the cable installation vessels. The Project will only restrict access within a narrow safety corridor around in-water work in the nearshore area.

Figure 10-1 Existing infrastructure at the Mombasa North (Shanzu Beach) landing

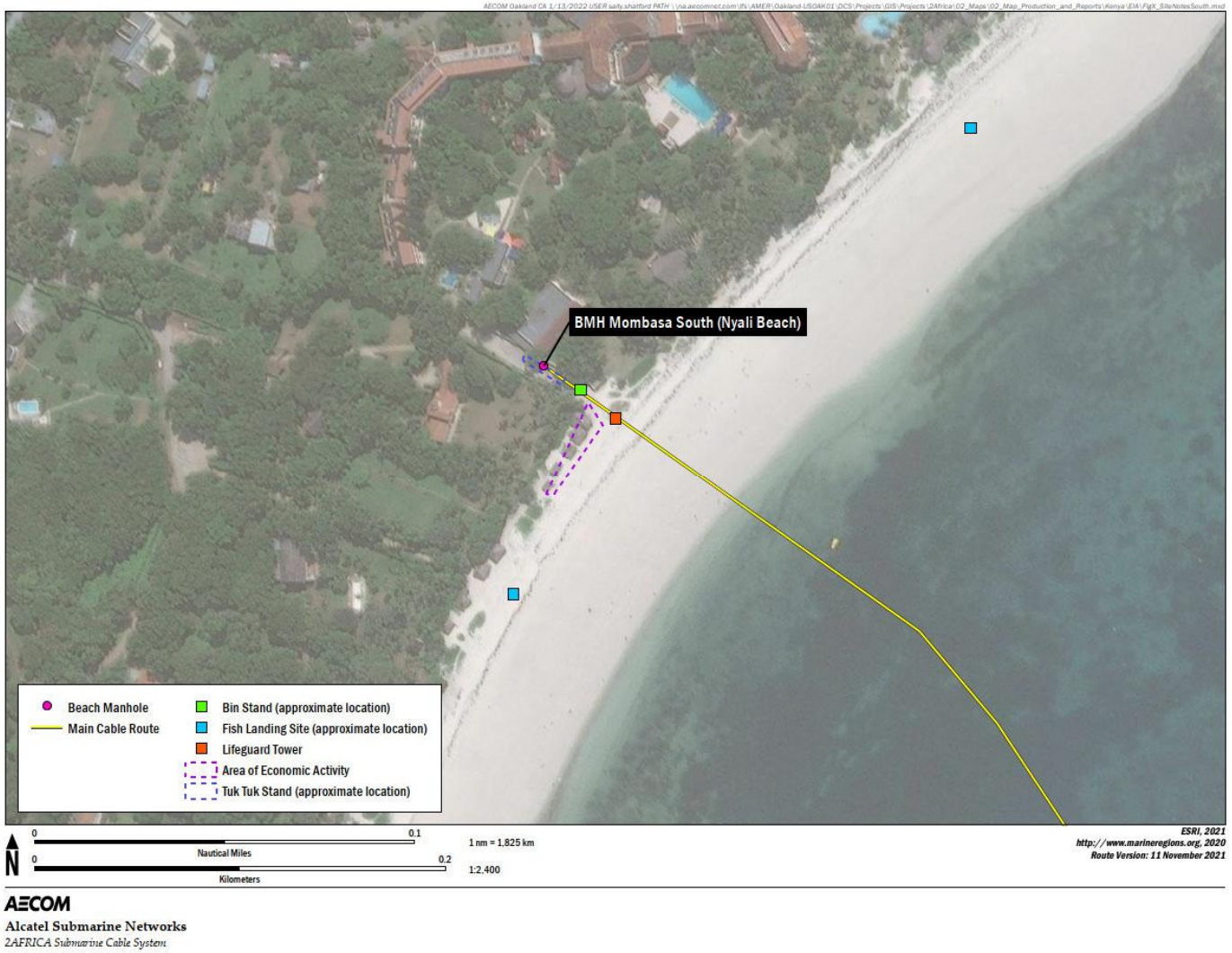


Figure 10-2 Existing infrastructure, fish landing sites, and vendor locations at the Mombasa South (Nyali Beach) landing

- Mombasa South (Nyali Beach): Typical fishing waters exist offshore in the area crossed by the proposed cable route, including within Mombasa MNR. There may be minor disruption to fishing activities during installation, but given the limited area required for cable installation, there should be sufficient space for fishermen to undertake their usual activities away from Project activities. The Project will only restrict access within a safety corridor around in-water work in the nearshore area.

Impacts on fish landing sites and fishing areas are a temporary, negative direct impact of short duration and local scale. As described above, no fish landing sites would be directly impacted by the Project. The PLSE and associated installation vessels will operate in the vicinity of the landing sites for 7 to 10 days per landing site, after which activities can resume as normal. With in-built mitigation, including advance notice and coordination with local authorities and BMUs, the significance of this impact is assessed as **minor.**

Assessment:

Receptors	**Physical**	N/A	
	Biological	N/A	
	Human	**Fisheries and other Sea Users, Recreation and Tourism:** Fishing, recreational activities and local operators may be temporarily disrupted during the installation activities.	
In-Built Mitigation	• Cable installation activities will occur in a designated area within which access would be temporarily restricted for public safety. • Kenya Maritime Authority will be given 1 month notice ahead of all installation activities, so that formal maritime notifications can be published. • The cable installer will provide 1 month's notice to authorities in advance of the start of work for the PLSE. The local BMUs will be notified through the public offices (*i.e.*, via the Deputy County Commissioner's offices at both locations, who would then inform the Chiefs, who would disseminate the information to the fishermen and the BMUs) with a minimum of 7 days' notice. • Each of the two beach landing sites will be restored to pre-installation conditions.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Minor	Medium	**Minor**
Additional Mitigation	None required		

10.4.4 Nuisance to Beach Users

Impact Description

The Earth System installation, trenching and cable pull to the BMH may require the temporary closure of an approximately 20 m working area within the beach and generate noise that may be a temporary nuisance to beach users, potentially causing some tourists and beach goers to avoid the immediate area for a few days. The shore-end landing itself is often a source of interest and may attract additional people to the beach to watch the landing, generating additional income for local vendors. The duration of all terrestrial construction and landing activities associated with the Project is expected to be 5 days or fewer per landing site (Section 3.3.4).

This is a negative direct impact but will be of short duration (occurring immediately during construction/ installation activities) and will take place during normal working hours. The impact is considered reversable because construction vehicles and workers will leave once the construction activities are complete. The impact is local in scale. With in-built mitigation measures in place, including appropriate signage and notifications, the impact is assessed as **minor** in significance.

Assessment:

Receptors	**Physical**	N/A
	Biological	N/A
	Human	**Recreation and Tourism, Recreational Community Features:** Beachgoers could adapt fairly easily to nuisance and move to a different beach or different section of the beach. Vendors would be vulnerable to fluctuations in income and may not have an alternative location to set up their business.
In-Built Mitigation	• All planned installation and construction activities will be limited to normal working daylight hours. • All construction machinery, plant and equipment shall be kept in good working order; operated according to the supplier's instructions; and equipped with noise reduction mufflers where necessary. • Contractors will be required to provide signage or pointsman (or similar) should temporary lane closures be required. • A community notification process will be implemented to advise neighbouring residencies, businesses, hotels or traders of the planned construction schedule and duration, or any planned closures or service interruptions. • In the event that any work is to be undertaken at night (*e.g.*, for emergency reasons), the neighbouring residencies, businesses, hotels or traders are to be notified of the activity as soon as practically possible.	
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Minor	Medium	**Minor**
Additional Mitigation	• The Project will abide by the EMCA noise and vibration regulations during onshore activities.		

10.4.5 Construction Emissions

Impact Description

Emissions from construction vehicles and equipment involved in the trenching and cable pull across the beach are a negative direct impact but will be of short duration (during construction activities). The excavation of the BMH and trench may result in temporary and localised dust. The impact is considered reversable because construction vehicles will leave after the construction activities are complete. The impact has a local scale. With in-built mitigation, and given the short duration of the construction activities, this impact is assessed as **negligible**.

Assessment:

Receptors	**Physical**	**Air Quality, Climate Change and GHG:** Vehicle emissions may temporarily impact the air quality of the local beach area.
	Biological	**Terrestrial (Beach) Habitats:** Vehicle emissions may temporarily affect air quality for beach areas in the immediate vicinity of construction.
	Human	**Recreation and Tourism:** Vehicle emissions may temporarily affect air quality in the local vicinity of the construction works.
In-Built Mitigation	• All construction machinery, plant and equipment shall be kept in good working order, operated according to the supplier's instructions and checked regularly to ensure that emissions comply with applicable air quality regulations.	
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Slight	Low	**Negligible**
Additional Mitigation	• Stockpiles will be managed for dust and protected by wetting or cover if dust proves a nuisance.		

10.4.6 Accidental Spills (Beach Construction)

Impact Description

Accidental leaks or spills from construction activity, vehicles or equipment may occur in the absence of in-built mitigation. This is a negative direct impact of short duration (occurring immediately during construction activities). The impact has a local scale, given the small amount of fuel or potentially hazardous materials associated with terrestrial construction (*i.e.*, fuel for construction vehicles). The impact is considered reversable because a small spill could be contained and restored effectively. With implementation of standard best-management practices, the significance of this impact will be **minor.**

Assessment:

Receptors	**Physical**	**Geology/Intertidal/Seabed Sediment and Water Quality:** Accidental spills or leaks, if not contained or attended to, may reach the sea, providing a pathway for pollution to reach marine waters.	
	Biological	**Terrestrial (Beach) and Nearshore Habitats:** Accidental spills or leaks, if not contained or attended to, may pollute local terrestrial and/or nearshore marine habitats.	
	Human	N/A	
In-Built Mitigation	• An Emergency Spill Response Plan and a Waste Management Plan will be implemented as part of onshore construction activities to put appropriate control and response measures in place.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Slight	Medium	**Minor**
Additional Mitigation	• Refuelling and equipment maintenance will be handled off site, or in a designated area with bunding for such purpose.		

10.4.7 Disruption to Existing Infrastructure

Impact Description

Existing infrastructure is present at both landing sites in the near vicinity of the proposed cable route.

- On Shanzu Beach, KWS has constructed a concrete block on the ground to store waste bins in the location of the proposed BMH. The concrete slab also incorporated bottles into the surface (Figure 10-1).
- On Nyali Beach, the BMU members have constructed a single-story structure used partly as a lifeguard watch tower on top and as a meeting venue below (Figure 10-2).

The Project has some flexibility to 'microsite' the cable, BMH and system earth to avoid existing infrastructure as needed. If existing structures cannot be avoided, the infrastructure will be reinstated or replaced, as agreed on with the owner/custodian, prior to removal. With this measure in place, impacts will be temporary (*i.e.*, during construction and replacement), reversible and local. The impact significance is therefore assessed as **minor.**

Assessment:

Receptors	**Physical**	**Damage to Existing Infrastructure**: Existing infrastructure at both site locations may need to be removed and later reinstated during the cable installation process.	
	Biological	N/A	
	Human	N/A	
In-Built Mitigation	• The cable and BMH installation will, where possible, avoid any existing infrastructure and services by routing the cable around such obstacles, thereby avoiding damage or disruption. • Where complete removal of infrastructure is required, the infrastructure will be reinstated or replaced, as agreed on with the owner/custodian, prior to removal (to pre-construction condition).		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Minor	Medium	**Minor**
Additional Mitigation	None required		

10.4.8 Community Health and Safety during Construction and Installation

Impact Description

Construction of beach infrastructure and the cable landing both have the potential for interactions with the local community, and therefore potential impacts on community health and safety. Use of construction equipment (*e.g.*, an excavator for trenching and cable pulling) represents a potential safety hazard for beachgoers in the vicinity of work. The Project has several in-built mitigation measures related to maintaining site safety, including establishing designated work areas, maintaining site control, communicating with local authorities, and restoring work areas to pre-installation conditions.

Construction of beach infrastructure (*e.g.*, BMH, system earth) is typically completed in advance of the cable landing by trained local personnel. During the cable landing and post-installation activities (*i.e.*, cable protection and burial), a small number of personnel—typically a mix of international and local workers—will be present to undertake construction and installation activities. The BMH will be built by the Landing Provider using a local contractor (up to six personnel) The main-lay vessel crew (up to six personnel) would sleep on board the vessel. The PLSE and post-installation activities (7 to 10 days per landing) would be undertaken by a specialist company (Kenyan or international) and could include up to 20 personnel, including dive teams.

There is some risk of disease transmission associated with the presence of national and international workers; however, the small number of staff and short duration of work limit the potential magnitude of this impact. All Project staff and subcontractors will comply with company and national requirements with regard to COVID-19, and are also required to complete mandatory compliance and ethics training and abide by the Nokia Code of conduct and the Responsible Business Alliance code of conduct, which include the respectful treatment of people.

This is a negative direct impact of short duration (during construction and installation) and local scale. Impacts to health could be irreversible if they occur; however, with in-built mitigation, the likelihood and magnitude of impacts from the Project is expected to be low. The significance of the impact is therefore assessed as **minor.**

Assessment:

Receptors	**Physical**	**N/A**	
	Biological	**N/A**	
	Human	Local community members could be exposed to safety risks associated with beach construction and installation and/or infectious disease carried by local or nonlocal workers.	
In-Built Mitigation	• All ASN staff and subcontractors are required to complete mandatory compliance and ethics training and abide by the Nokia Code of conduct and the Responsible Business Alliance code of conduct, which includes the respectful treatment of people. • Safe distances from equipment and designated work areas will be established and enforced. • Appropriate agencies, local authorities and community groups will be engaged and communicated with in advance. • Site access control will be maintained. • Clean work areas will be maintained, and Project-related refuse will be removed at the end of each day. • Work areas will be restored to pre-installation conditions.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Low	Medium	**Minor**
Additional Mitigation	None required		

10.5 Operation and Maintenance

10.5.1 Operation

Once installed, submarine cables do not require routine maintenance or inspection for the duration of the cable's operation. Operation of the cables is powered from shore-based cable-landing stations and

boosted through the system by repeaters. Cables may not require repair at all during their operational lifetime. They are, however, installed in a way that enables faults to be detected and located remotely and repairs to be carried out if necessary. Cable repair involves vessels and techniques similar to those used in cable installation. The cable section that has shown a fault or is damaged would be identified, and a cable repair vessel would be dispatched to the repair location. A grapnel would be used to bring the cable up to the vessel for repair, and the repaired cable segment would then be placed on the seafloor. Depending on the location of the repair, the cable may be reburied.

10.5.1.1 Presence of the Cable on the Seabed

Impact Description

The placement on the seabed of infrastructure, such as cable and articulated pipes, provides an area of hard substrata that can be colonised by benthic fauna along some portions of the cable route (*i.e.*, surface-laid sections in favourable conditions).

This 'reef effect' is typically regarded as a positive anthropogenic impact because artificial reefs generally have higher diversity, densities and biomass of epifauna, flora, fish and decapod crustaceans than surrounding soft sediments. Sessile organisms common to the area such as sponges, hydroids, bryozoans, and ascidians may also colonise introduced hard substrate (Kogan *et al.* 2006).

The width of the cable (between 17 and 50 mm) is considered too small to accommodate hard substrata communities of any significant abundance. This is a neutral direct impact and will be of long duration and local scale.

The presence of the cable on the seabed through the EEZ results in some potential for interaction with other sea users (*e.g.*, entanglement with fishing gear, anchors or other equipment used in sea-bottom activities). For this reason, the cable will be buried up to 2 m below the seabed up to 1,000 m water depth, wherever seabed conditions allow. As shown in Figure 3-18, burial is planned for the majority of both the Mombasa North (Shanzu Beach) and Mombasa South (Nyali Beach) cable branches. Cable burial helps to protect the cable from damage and helps to minimise interference for other sea users. The Project will also provide the final cable location to the relevant authorities to include in admiralty charts and for communication with other sea users.

This is a negative impact of long-term duration but extremely local in scale (*i.e.*, limited to the cable corridor in sections of the cable where burial cannot be achieved). With in-built mitigation measures in place, impacts from presence of the cable on the seabed are expected to be **minor.**

Assessment:

Receptors	**Physical**	**Geology/Intertidal/Seabed Sediment and Water Quality:** The 'reef' effect may change the geomorphology of the immediate environment around the cable.	
	Biological	**Intertidal and Benthic Ecology:** Benthic species may form a habitat along some portions of exposed cable.	
	Human	**Fishermen and other Sea Users:** Bottom-fishing activities such as trawling, as well as anchoring of large and small vessels, have the potential to interact with the cable once installed on the seabed.	
In-Built Mitigation	• The cable will be buried where feasible in water depths shallower than 1,000 m, to avoid conflicts with other marine users and marine species. • The final cable alignment will be provided to the relevant authorities to be added to national and international navigation charts.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Low	Various	**Minor**
Additional Mitigation	None required		

10.5.1.2 Electromagnetic Fields

Background electromagnetic fields (EMFs) occur naturally in the marine environment. Power support to the cables is technically high voltage (defined as more than 380/440 volts); however, the cable is well insulated and protected, resulting in an EMF profile similar to background levels that occur naturally in the marine environment. This is also a significantly smaller EMF than would be expected from other types of subsea cables—specifically electrical transmission cables. The proposed cable installation is a "repeatered" system. To prevent the optical signal from deteriorating from the point of origin to the destination, the signal is boosted (or 'repeated') with a low power supply (typically less than 1 ampere) approximately every 70 km. A small electric current is expected to be emitted, but it would be extremely low current. No impact would be expected from electromagnetic fields or heat to the surrounding sediment or seabed. The electromagnetic field will be approximately 1,000 times lower than that of high-voltage direct current cables.

Although there is some evidence that some benthic invertebrates are able to detect EMF (Scott 2018), the EMF strength (2.8 millitesla) studied in that experiment was significantly higher than that produced by electrical transmission cables, and therefore much higher than that which may be expected from telecommunications cables. Other studies around an active subsea electrical transmission cable in Puget Sound found that the cable had no impact on crab behaviour, including movement across the cable (Love *et al.* 2017). Other studies also indicate that invertebrates are not particularly sensitive to EMF.

Based on a review of existing literature and considering the anticipated EMF profile of the proposed cable system, no significant effect on marine biota is anticipated as a result of operational EMF from the proposed cable.

Assessment:

Receptors	**Physical**	**N/A**	
	Biological	**Fish and marine mammals** may be sensitive to EMF.	
	Human	N/A	
In-Built Mitigation	Cable insulation and protection result in an EMF profile similar to background levels.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	No impact	Various	**No Impact**
Additional Mitigation	None required		

10.5.1.3 Cable Repairs

Impact Description

If a cable is damaged, cable repair activities would be carried out using methods the same as or similar to those used for cable installation; therefore, the potential impacts on benthic ecology would be similar to those identified for the cable installation phase. Furthermore, because works would be highly localised to the area of the repair, the spatial extent of any impacts would be limited to the specific repair location. The duration of repair activity would be anticipated to be brief, and effects would also be of short duration. Impact significance would therefore be **minor** or lower for all effects associated with cable repair.

Assessment:

Receptors	**Physical**	**Geology/Intertidal/Seabed Sediments:** Soft sediment will be disturbed and may be resuspended, possibly resettling in nearby locations. **Water Quality:** Sediment in suspension can cause reduce visibility.	
	Biological	**Benthic Ecology, Fish and Shellfish:** The resuspension and resettling of sediment may temporarily impact the habitat of these receptors.	
	Human	**Fishermen and other Sea Users:** Cable repairs may result in temporary and localised access restrictions for sea users in the immediate vicinity of a repair.	
In-Built Mitigation	• Notifications will be made to appropriate authorities and marine users, depending on the location and timing of a necessary repair.		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Slight	Various	**Minor**
Additional Mitigation	N/A		

10.5.2 Socioeconomic Enhancement

Impact Description

The enhancement of communications and global connectivity will enhance economic development in Kenya, affecting local businesses, education and employment opportunities in Kenya. This is a **positive** direct impact of long-term duration. The impact has a national scale.

Assessment:

Receptors	**Physical**	**N/A**	
	Biological	**N/A**	
	Human	The Project will benefit Kenya by: • providing reliable international communications; • stimulating investment and economic growth; and • easing access to education and broad knowledge.	
In-Built Mitigation	N/A		
Rating	**Magnitude**	**Receptor Sensitivity**	**Significance**
	Positive	Various	**Positive**
Additional Mitigation	N/A		

10.6 Decommissioning

The cable will continue to have a passive, benign influence on the environment and will not degrade or pollute the environment.

A decommissioning plan will be developed at the end of the cable's useful life, considering best practice at that time. The plan will consider the potential for environmental and social impacts of decommissioning alternatives (*i.e.*, cable removal or cable abandonment). Conservation and marine biologist specialists may be consulted to provide advice on the best course of action.

11. Environmental and Social Management Plan

This ESMP provides a framework within which the negative environmental and social impacts identified during the EIA study can be mitigated, and any beneficial environment effects can be enhanced. Responsibilities for the implementation of the various aspects of the ESMP are identified. The ESMP provides a demonstration of the capacity of responsible parties to implement identified mitigation measures, timing and the monitoring and evaluation strategies to be adopted.

The ESMP should be considered a living document and will be updated to incorporate any additional permit requirements or regulatory requirements identified through the permitting process and agency coordination for the Project.

Table 11-1: Environmental and Social Management Plan

Impacts	In-Built Mitigation	Additional Mitigation Measures	Responsible Party	Timing
All Phases: Vessel Usage				
Increase in vessel traffic and temporary access restrictions	• Kenya Maritime Authority will be given 1 month notice ahead of all installation activities, so that formal maritime notifications can be published. • Early engagement and communication will take place with local ports authorities, naval command, touristic boat companies and fishermen in the area (local BMUs), including discussion of avoidance, management and mitigation measures to limit impacts on local sea users. • Engagement with the State Department of Fisheries will take place to further define avoidance and mitigation requirements as necessary.	None required.	Cable Installer	Prior to Installation Pre-Installation Works and Cable Lay (*i.e.*, ongoing communication as required)
Introduction of invasive non-native species	• All international Project vessels will comply with the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention), and the control and management of ships' biofouling to minimise the transfer of invasive aquatic species (2011 IMO Biofouling Guidelines, 2011). • Project equipment such as the plough, ROV, and grapnels will be cleaned between landings in compliance with the 2011 IMO guidelines above. • Ballast waters will be managed in accordance with the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (BWM Convention, IMO 2017).	None required.	Vessel Crew	Pre-Installation Works Cable Lay

Impacts	In-Built Mitigation	Additional Mitigation Measures	Responsible Party	Timing
Discharge and emissions from vessels	• All vessels wastes will be managed in accordance with the requirements set out within the International Convention for the prevention of pollution from ships (MARPOL), specifically Annex I, which covers prevention of pollution by oil and oily water; Annex IV, covering prevention of pollution by sewage; and Annex V, which sets out regulations for the prevention of pollution by garbage. ○ For example, MARPOL requires that untreated sewage may only be discharged at a distance of more than 12 nautical miles from the nearest land, provided that sewage held in holding tanks is not discharged instantaneously, but at a moderate rate when the ship is en-route and proceeding at a speed of not less than 4 knots. ○ By complying with MARPOL, discharge from vessels likewise will not take place within the Mombasa MNP or the Mombasa MNR. • All vessels will comply with MARPOL 73/78 Annex VI on air pollution, and with the NOx Technical code (2008) Guidelines for Implementation, 2017 edition (IMO 2017). • Vessel fuels will comply with International Maritime Organisation/MARPOL specifications with a sulphur limit of 3.5% percent, and no ozone- depleting substances shall be used. On this basis, vessel emissions will be kept as low as reasonably practicable.	None required.	Vessel Crew	Pre-Installation Works Cable Lay

Impacts	In-Built Mitigation	Additional Mitigation Measures	Responsible Party	Timing
Underwater noise and disturbance	• Project vessels will travel at slow speeds (between 0.5 and 4.0 knots, depending on installation method) or less (*e.g.*, holding position during the shore-end landing). Reducing ship speed can be a very effective operational measure for reducing underwater noise, especially when it becomes lower than the cavitation inception speed. • The cable lay vessel and shore-end barge will be maintained according to the IMO Guidelines (2014) to reduce underwater noise, including: – Propeller polishing done properly will remove marine fouling and vastly reduce surface roughness, helping to reduce propeller cavitation. – Maintaining a smooth underwater hull surface and smooth paintwork may also improve a ship's energy efficiency by reducing the ship's resistance and propeller load. Hence, it will help to reduce underwater noise emanating from the ship. – The installation vessels will be equipped with fixed pitch propellers. • The Project will abide by the Resolution MSC 337(91) code on noise levels on board ships. • The Marine Mammal (and other Megafauna) Protocol will be discussed with and agreed on by all parties prior to installation commencing.	None Required	Vessel Crew	Pre-Installation Works Cable Lay

Impacts	In-Built Mitigation	Additional Mitigation Measures	Responsible Party	Timing
Accidental leaks and spills	• All vessels will comply with MARPOL Annex I – Prevention of Pollution by Oil and will have a contingency plan for marine oil pollution in the form of Shipboard Oil Pollution Emergency Plan. • All vessels will have chemical handling procedures for oils and fuels in place and Health Safety and Environmental monitoring procedures, with weather and personnel limits to be implemented during cable installation. • Kenyan Oil Spill mitigation measures adopted by OSMAG will be adopted for the Project. • KPA and OSMAG will be informed of installation timing in advance of the cable installation. • An Emergency Spill Response Plan and a Waste Management Plan will be implemented as part of onshore construction activities to ensure that appropriate control and response measures are in place.	None Required	Vessel Crew	Pre-Installation Works Cable Lay
Interactions between vessels and megafauna	• Project vessels will operate at speeds of 4 knots or less while laying and burying cable. • Safety zone separations from sighted marine mammals or turtles will be implemented. More specifically, vessels will temporarily halt operations when sea turtles or marine mammals are spotted within a 90 m buffer.	• A Marine Megafauna Protocol shall be developed and implemented in coordination with KWS; this may include, for example: – A response plan in the event of megafauna collision – Implementing a safety zone and/or speed restriction on the sighting of pods of whale species, bait balls (*i.e.*, large, tightly packed formations of fish) or slow-moving megafauna such as Whale Sharks	Vessel Crew	Pre-Installation Works Cable Lay
Use of anchoring systems in shallower waters	• The PLSE barge will use DP to maintain position for the shore-end landing, thereby avoiding the need for anchoring. The main-lay vessel will likewise use DP during cable lay in deeper waters. • Smaller vessels associated with the shore-end landings will comply with anchoring requirements in the MPA; use established anchoring locations, if available; and avoid anchoring in sensitive habitats (*e.g.*, coral reefs).	• An anchoring plan will be prepared for installation near coral reefs, in consultation with KWS. This may include, for example, prohibiting anchoring close to sensitive habitats within shallow waters.	Cable Installer Vessel Crew	Cable Lay

Impacts	In-Built Mitigation	Additional Mitigation Measures	Responsible Party	Timing
Visual disturbance from the vessel	• Lighting on the cable ship will be directional and hooded/shaded as necessary to reduce unnecessary light spill. • Operations close to the shore will be performed during the day, avoiding lighting disturbance.	None required.	Cable Installer Fleet Operations Vessel Crew	Pre-Installation Works Cable Lay
Pre-Installation Works: Route Clearance				
Disturbance by resuspension of sediment	N/A	None required.		Pre-Installation Works
OOS cable disposal onshore	• Metal components of OOS cable sections are typically removed for recycling. • Wastes will be managed in accordance with applicable regulations and industry practice, following protocols and requirements for disposal of wastes, using appropriately licensed facilities and service providers. • OOS cable segments removed during route clearance will be disposed of on completion of the operations in accordance with local regulations. • All waste disposal facilities used will be fully and appropriately licensed, with suitable ESMPs in place for the waste management streams in question.	None required.	Cable Installer	Pre-Installation Works
Pre-Installation Works: Pre-Lay Grapnel Run				
Disturbance by resuspension of sediment	The duration of the activity will be kept as short as possible.	None required.	Cable Installer	Pre-Installation Works
Debris disposal onshore	• Wastes will be managed in accordance with applicable regulations and industry practice, following protocols and requirements for disposal of wastes, using appropriately licensed facilities and service providers. • Debris recovered during these operations will be discharged ashore on completion of the operations and disposed of in accordance with local regulations. • All onshore yards and disposal sites used will be fully and appropriately licensed, with suitable ESMPs in place for the waste management streams that will be required.	None required.	Cable Installer	

Impacts	In-Built Mitigation	Additional Mitigation Measures	Responsible Party	Timing
Cable-Lay Activities: Offshore Cable Installation				
Benthic habitat disturbance	• The route survey allows for selection of seabed that provides good conditions for burial. • Sea-ploughs used for subsea cable burial have been optimised by the industry to limit physical impacts to a narrow furrow (approximately 1 m wide by up to 3 m deep), plus the impact of the sled 'skis' as they cross the seabed.	None required.	Cable Installer	Route Planning Cable Lay
Cable-Lay Activities: Nearshore Cable Installation				
Benthic habitat disturbance	• The geophysical route survey was undertaken to determine the optimum alignment of the cable that would avoid hard structures such as corals and other high-value ecological receptor wherever possible. • Use of diver-jetting in shallow waters and/or near sensitive receptors will help to minimise impacts during burial.	None required.	Cable Installer	Route Planning Cable Lay
Impacts on coral and seagrass habitat	• Use of divers to hand-lay the cable will enable the Project to avoid most impacts on living coral. • Use of diver jetting will help to reduce the impact on surrounding habitats from sediment disturbance during burial of the cable in soft-bottom substrates. • The tension and weight of the cable, at > 6 kg per metre, helps to maintain the cable in position on the seabed except in extremely high-energy environments (> 4 knot perpendicular current). • If the cable engineers determine that cable movement is likely, clamps will be applied to further secure the cable to the seabed.	• The cable installer will coordinate with KWS in advance of and during the pre-lay swim, to refine the cable alignment within the Mombasa MNR. • Cable installation in the vicinity of coral habitat will take place within appropriate sea-state conditions and tidal conditions (*i.e.,* water level at the reef); to be defined in consultation with KWS.	Cable Installer	Route Planning Cable Lay

Impacts	In-Built Mitigation	Additional Mitigation Measures	Responsible Party	Timing
Cable Landing				
Disturbance to terrestrial habitat and species	• Installation activities will occur in daylight hours; therefore, beach lighting at night will not be required. If night lighting is required for public safety, the lighting can be shielded and/or directed away from the beach. • The beach trench will be limited to as narrow a corridor as is safe and technically feasible. • Soil and aggregates will be stored away from any drainage areas during onshore trenching. • The beach will be restored to its original condition; the trench will be backfilled to its original contour with the original material. • The beach will be restored as quickly as technically feasible following installation of the cable. • The Project will abide by the EMCA noise and vibration regulations during onshore activities.	• Turtle nest monitoring will be conducted within the Project footprint prior to installation to check for turtle nests and recent turtle activity. The timing (*i.e.*, days in advance of beach works) and details of turtle monitoring will be coordinated with KWS to meet Kenyan requirements. If active nests and/or nesting attempts are observed by monitors, appropriate mitigation measures—for example, temporary fencing and monitoring during beach works—to avoid nest disturbance will be taken by the Project in consultation with KWS.	Cable Installer	Shore-End Cable Landing
Beach parking and access constraints	• The extent and duration of road closures or parking impacts will be limited to the greatest extent practicable, avoiding closure of the road if possible.	• A 2-week notice period will be provided to surrounding businesses, traders and hotels of the planned installation works duration and schedule. The local community and beach users will be informed of the planned installation activities through local radio stations, newspaper adverts, public notices or other similar means. • The BMH installation activities will be scheduled to avoid peak holiday periods, if possible.	Local landing provider (responsible for BMH construction) Cable installer (responsible for shore-end landing and beach works)	Terrestrial Construction and Shore-End Cable Landing
Access restrictions for local fishermen	• Cable installation activities will occur in a designated area within which access would be temporarily restricted for public safety. • Kenya Maritime Authority will be given 1 month's notice ahead of all installation activities, so that formal maritime notifications can be published. • Each of the two beach landing sites will be restored to pre-installation conditions.	• The cable installer will provide 1 month's notice to authorities in advance of the start of work for the PLSE. The local BMUs will be notified through the public offices (*i.e.*, via the Deputy County Commissioner's offices at both locations, who would then inform the Chiefs who would disseminate the information to the fishermen and the BMUs) with a minimum of 2 weeks' notice.	Cable Installer	Shore-End Cable Landing

Impacts	In-Built Mitigation	Additional Mitigation Measures	Responsible Party	Timing
Nuisance to beach users	• All planned beach installation and construction activities will be limited to normal working daylight hours.	• A community notification process will be implemented to advise neighbouring residencies, businesses, hotels or traders of the planned construction schedule and duration, or any planned closures or service interruptions. • Contractors will be required to adhere to speed restrictions and the associated safety requirements of signage or pointsman (or similar) should temporary lane closures be required. This will reduce the nuisance impacts to beachgoers and road users. • In the event that any work is to be undertaken at night (*e.g.*, for emergency reasons), then the neighbouring residencies, businesses, hotels or traders are to be notified of the activity as soon as practically possible. • All construction machinery, plant and equipment shall be kept in good working order, operated according to the supplier's instructions and equipped with noise reduction mufflers where necessary. • The Project will abide by the EMCA noise and vibration regulations during onshore activities.	Cable Installer Local landing provider (responsible for BMH construction)	Terrestrial Construction and Shore-End Cable Landing
Construction emissions	• Construction machinery will be serviced and/or checked regularly to ensure that emissions comply with applicable air quality regulations.	• Stockpiles will be managed for dust and protected by wetting or cover if dust proves a nuisance.	Cable Installer Local landing provider (responsible for BMH construction)	Terrestrial Construction and Shore-End Cable Landing
Accidental spills (beach construction)	• An Emergency Spill Response Plan and a Waste Management Plan will be implemented as part of onshore construction activities to put appropriate control and response measures in place.	• Refuelling and equipment maintenance will be handled off site, or in a designated area with bunding for such purpose.	Cable Installer Local landing provider (responsible for BMH construction)	Terrestrial Construction and Shore-End Cable Landing

Impacts	In-Built Mitigation	Additional Mitigation Measures	Responsible Party	Timing
Disruption to existing infrastructure	• The cable and BMH installation will, where possible, avoid any existing infrastructure and services by routing the cable around such obstacles, thereby avoiding damage or disruption. • Where complete removal of infrastructure is required, the infrastructure will be reinstated or replaced, as agreed on with the owner/custodian, prior to removal (to pre-construction condition).	None required.	Cable Installer Local landing provider (responsible for BMH construction)	Terrestrial Construction and Shore-End Cable Landing
Community health and safety during construction and installation	• All ASN staff and subcontractors are required to complete mandatory compliance and ethics training and abide by the Nokia Code of conduct and the RBA code of conduct, which includes the respectful treatment of people. • Safe distances from equipment and designated work areas will be established and enforced. • Appropriate agencies, local authorities and community groups will be engaged and communicated with in advance. • Site access control will be maintained. • Clean work areas will be maintained, and Project-related refuse will be removed at the end of each day. • Work areas will be restored to pre-installation conditions.	None required.	Cable Installer Local landing provider (responsible for BMH construction)	Terrestrial Construction and Shore-End Cable Landing
Operation and Maintenance: Operation				
Presence of the cable on the seabed	• The cable will be buried where feasible in water depths shallower than 1,000 m, to avoid conflicts with other marine users and marine species. • The final cable alignment will be provided to the relevant authorities to be added to national and international navigation charts.	None required.	System Owner	After completion of installation
Electromagnetic fields	N/A	None required.		
Cable repairs	• Notifications will be made to appropriate authorities and marine users, depending on the location and timing of a necessary repair.	None required.	System Owner and/or Cable Repair Team	As-needed (operation phase)

Impacts	In-Built Mitigation	Additional Mitigation Measures	Responsible Party	Timing
Operation and Maintenance: Socioeconomic enhancement				
Socioeconomic enhancement	N/A	N/A		

Notes:

ASN = Alcatel Submarine Networks
BMH = beach manhole
BMU = Beach Management Unit
DP = dynamic positioning
EMCA = Environmental Management and Coordination Act
KPA = Kenya Ports Authority
kg = kilograms
KWS = Kenya Wildlife Service
m = metre
MARPOL = International Convention for the Prevention of Pollution from Ships
MNR = Marine National Reserve
MNP = Marine National Park
NOx = oxides of nitrogen
OOS = out of service
OSMAG = Oil Spill Mutual Aid Group
PLSE = pre-laid shore end
RBA = Responsible Business Alliance

12. Conclusions and Recommendations

Two landings are proposed in Kenya for the 2Africa cable system, both in Mombasa: 'Mombasa North' on Shanzu Beach and 'Mombasa South' on Nyali Beach. The system is expected to be ready for service in 2023, delivering more than the total combined capacity of all subsea cables serving Africa today. 2Africa will deliver much-needed internet capacity and enhance reliability across large parts of Africa; supplement the fast-growing capacity demand in the Middle East; and underpin the further growth of 4G, 5G and fixed broadband access for hundreds of millions of people.

Table 12-1 provides a summary of potential impacts from the proposed Project, with consideration of in-built mitigation.

Table 12-1: Summary of impacts

Activity	Impact	Phase	Significance
Vessel Usage	Increase in vessel traffic and temporary access restrictions	Installation	Minor
	Introduction of invasive non-native species	Installation	Minor
	Discharge and emissions from vessels	Installation	Minor
	Underwater noise and disturbance	Installation	Minor
	Accidental leaks and spills	Installation	Minor
	Interaction between vessels and marine megafauna	Installation	Moderate
	Use of anchoring in shallow waters	Installation	Minor
	Visual disturbance from vessels	Installation	Negligible
Route clearance	Disturbance by resuspension of sediment	Installation	Negligible
	OOS cable disposal onshore	Installation	Negligible
Pre-lay grapnel run	Disturbance by resuspension of sediment	Installation	Minor
	Debris disposal onshore	Installation	Negligible
Cable lay in deep water	Benthic habitat disturbance	Installation	Minor
Cable lay in shallow water	Benthic habitat disturbance	Installation	Minor
	Impacts on coral and seagrass habitat	Installation	Moderate
Cable landing	Disturbance to terrestrial habitat and species	Installation	Moderate
	Beach parking and access constraints	Installation	Moderate
	Access restrictions for local fishermen	Installation	Minor
	Nuisance to beach users	Installation	Minor
	Construction emissions	Installation	Negligible
	Accidental spills and leaks	Installation	Minor
	Disruption to existing infrastructure	Installation	Minor
	Community health and safety	Installation	Minor
Operation and Maintenance	Presence of the cable on the seabed	Operation	Minor
	Electromagnetic fields	Operation	No Impact
	Cable repairs	Maintenance	Minor
	Socioeconomic enhancement	Operation	Positive Impact

Note:
OOS = out of service

Although the magnitude of most Project impacts is minor, four activities were assessed to have potential impacts of **moderate** significance, largely due to the sensitivity of the receiving environment. The additional mitigation measures listed in Table 12-2 are therefore recommended for these activities.

Table 12-2: Additional mitigation measures

Activity	Impact	Additional Mitigation
Vessel Usage	Interaction between vessels and marine megafauna	• A Marine Megafauna Protocol shall be developed and implemented in coordination with KWS; this may include, for example: – A response plan in the event of megafauna collision – Implementing a safety zone and/or speed restriction on the sighting of pods of whale species, bait balls (*i.e.*, large, tightly packed formations of fish) or slow-moving megafauna such as Whale Sharks
Cable lay in shallow water	Impacts on coral and seagrass habitat	• The cable installer will coordinate with KWS in advance of and during the pre-lay swim to refine the cable alignment in the Mombasa MNR. • Cable installation in the vicinity of coral habitat will take place within appropriate sea-state conditions and tidal conditions (*i.e.*, water level at the reef); to be defined in consultation with KWS.
Cable landing	Disturbance to terrestrial habitat and species	• Turtle nest monitoring will be conducted within the Project footprint prior to installation to check for turtle nests and recent turtle activity. The timing (*i.e.*, days in advance of beach works) and details of turtle monitoring will be coordinated with KWS to meet Kenyan requirements. If active nests and/or nesting attempts are observed by monitors, appropriate mitigation measures—for example, temporary fencing and monitoring during beach works—to avoid nest disturbance will be taken by the Project in consultation with KWS.
	Beach parking and access constraints	• A 2-week notice period will be provided to surrounding businesses, traders and hotels, alerting them to the planned duration and schedule of installation work. The local community and beach users will be informed of the planned installation activities through local radio stations, newspaper adverts, public notices or other similar means. • The BMH installation will be scheduled to avoid peak season holiday periods, if possible.

Notes:

BMH = beach manhole
BMU = Beach Management Unit
KWS = Kenya Wildlife Service
m = metre
MNR = Marine National Reserve

With implementation of these and other mitigation measures presented in Chapter 10 and Chapter 11, all residual impacts of the Project are expected to be of **minor** significance or less. Therefore, it is our recommendation that the Project be authorised, provided the mitigation measures are adhered to as outlined in the ESMP.

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Appendix A Practicing Licenses of the Lead and Associate Experts, CVs

Lead Expert

Greg McAlister, BSc, MEnvS, MIEnvSc, CEnv, CSci
Associate Director

Education
Master of Environmental Studies (MEnvS) with Distinction, University of Strathclyde (2003)
BSc Chemical Engineering, University of Paisley (2001)

Country experience
Argentina, Armenia, China, Egypt, Germany, India, Ireland, Jamaica, Jordan, Kazakhstan, Kenya, Liberia, Lithuania, Malawi, Mali, Mexico, Mongolia, Nigeria, Pakistan, Philippines, Poland, Saudi Arabia, Serbia, Turkey, Uganda, Ukraine, United Kingdom, Uzbekistan and Zambia.

Language skills
English

Years of experience
18

Years with AECOM
7 months

Professional Accreditations/Certifications
Member of the Institution of Environmental Sciences (MIEnvSc), Chartered Environmentalist (CEnv), Chartered Scientist (CSci)
National Environmental Management Authority (Kenya) EIA Lead Expert (License 8927), Lead Member of the Environment Institute of Kenya

Key skills
Lender E&S Advisor, Environmental and Social Due Diligence (ESDD), Environmental and Social Impact Assessment (ESIA), Environmental and Social Construction Monitoring, Resettlement Action Plans, Livelihood Restoration Plans (LRPs), Project Management

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Greg has extensive experience in undertaking Environmental and Social Impact Assessments and site surveys throughout the world and has a comprehensive knowledge of international lending standards. He has experience across multiple sectors including renewable energy, pipelines, O&G and residential/commercial developments.

Professional history

Greg is a Chartered Environmentalist and Chartered Scientist with 18 years' experience across the public and private sectors.

He has managed a wide range of environmental projects and has particular experience in ESDD, ESIA, planning, permitting, environmental management systems and environmental auditing. He has experience across a wide range of sectors and technologies including solar PV, thermal power, hydro, onshore and offshore wind power, O&G, cross-country pipelines and other infrastructure projects. Greg has a comprehensive understanding of international lending standards and has worked on behalf of the world's leading project financers. He has also delivered training courses and lectures in his area of expertise. He is author of the revised World Bank Group sector specific EHS guidelines for wind energy and provided environmental input into the IFC's revised solar guidebook: Utility-Scale Solar Photovoltaic Power Plants: A Project Developer's Guide.

In addition to extensive experience in the UK, other recent project examples completed in accordance with EPs, World Bank Group EHS Guidelines and, as appropriate, IFC PSs including the ESIA of five solar projects in Kenya; ESDD of hydro projects in the UK, Turkey and Pakistan; ESDD of multiple sites in Central and South America, ESIAs of solar PV projects across sub-Saharan Africa; and ESIA of three wind projects in Kenya.

Selected Project Experience

Windlab, Meru Wind Farm, Kenya (2019)

PM for the ESIA of the wind farm project in Meru County. Scoping survey took place in Nov 2019. Reviewed two areas of search. Prepared ESIA Scoping Reports.

Frontier, Chania 50 MW Wind Farm, Kenya (Aug 2018 – 2019)

PM for the ESIA of the wind farm project south east of Kiserian on the Rift Valley. Responsible for the preparation of the ESIA report. Managed all specialist input into the ESIA including UK and Kenyan specialists. Bird survey work commenced with spring 2018 migration and included a year of surveys. Carried out a range of stakeholder engagement activities.

Globeleq, Frontier and Craftskills, Esidai 50 MW Wind Farm, Kenya (Aug 2017 – 2019)

PM for the ESIA of the wind farm projects on the Rift Valley. Responsible for the preparation of the ESIA report. Managed all specialist input into the ESIA including UK and Kenyan specialists. Bird survey work commenced with autumn 2017 migration and included a year of surveys.

TransMara and Samburu Kwale 2 x 10 MW Solar PV, ESIA, Gigawatt Global, Kenya (2017-2018)
PM for the ESIA of the 2x10MW solar PV projects. Responsible for the preparation of the ESIA report and managing all specialist input into the ESIA. Site visits completed in 2017. Both applications approved by NEMA. ESIAs were both upgraded to meet Equator Principles and IFC Performance Standards.

Lewa and Sergoit 2 x 10 MW Solar PV, ESIA, SolarCentury East Africa, Kenya (2016-2018)
PM for the ESIA of the 10MW solar PV project. Responsible for the preparation of the ESIA report and managing all specialist input into the ESIA. Site visits completed in December 2016 and January 2017. Both applications approved by NEMA. ESIAs were both upgraded to meet Equator Principles and IFC Performance Standards.

Mount Coffee Solar PV, Feasibility Study, Gigawatt Global, Liberia (2019)

PM for the feasibility study and led the site visit team. Report content included: Site evaluation and access analysis, Electricity evacuation analysis, Solar resource assessment (P50) based on publicly available data and conceptual layout, Initial energy yield assessment and initial cost estimates, Initial Environmental and Social Analysis.

E&S Due Diligence. 5 solar PV assets, Confidential Client, Colombia (2020).

Greg is Project Manager (PM) for the recently won ESDD of five solar PV projects across Colombia. Projects will be reviewed against Equator Principles and Performance Standards. Site visits will be carried out. Construction and operational monitoring will take place in 2021 and 2022.

Jigawa 50 MW Solar PV, Resettlement Action Plan and Livelihood Restoration Plan, Phanes Group, Nigeria (2018)

PM for the preparation of the livelihood restoration plan for the 50MW project in Jigawa State, Nigeria, which included a Food Vulnerability and Security survey.

Nkhotakota 21 MW Solar PV, Feasibility, Topo Survey, ESIA and LRP, Phanes Group, Malawi (2018-2019)

PM for the ESIA of 21MW solar PV project. Greg was responsible for the preparation of the ESIA report to international standards (IFC) and managed all specialist input into the ESIA. The work included a site visit completed and topographic survey, preparation of a Feasibility report and an ESIA report to local and International standards.

Sokoto 55 MW Solar PV, ESIA, Phanes Group, Nigeria (2017-2018)

PM for the ESIA of 55MW solar PV project. Greg was responsible for the preparation of the ESIA report to Equator Principles and IFC Performance Standards and managed all specialist input into the ESIA. Site visit completed in August 2017. Lending was agreed in principle with FMO. Project will now be subject to Lender's due diligence process.

Mayuge 10 MW Solar PV, ESIA, Emerging Power Uganda, Uganda (2016)

PM for the ESIA of the 10MW solar PV project. Prepared the ESIA report and managed all specialist input into the ESIA and managing Ugandan sub-consultants. Detailed survey work undertaken in Oct 2016 including LVIA, biodiversity and public meeting.

Mulungushi Hydro / Solar PV Feasibility Study, Zambia (2016)

Carried out a feasibility study on behalf of Mulungushi Hydro Power Company which considered the suitability of the site to accommodate development of solar PV in combination with 80MW hydro. Reviewed site conditions, grid capacity, technical feasibility, initial design, energy yield and financial modelling. Site survey was undertaken in July 2016.

Navoi Solar PV Project ESIA, Masdar, Uzbekistan (2020)

Greg was Project Manager (PM) for the ESIA and scoping study for the 100MW solar project. Greg was responsible for Managing preparation of the ESIA Preliminary Report, with a full ESIA now under preparation. Project undertaken in accordance with Equator Principles, EBRD Performance Requirements and IFC Performance Standards. Project reached financial close in Dec 2020.

Proparco, Credit Agricole, EKF. Golden Eagle Portfolio, Mexico (2019)

Environmental advisor to Lender's Group ensuring project compliance with Equator Principles and IFC Performance Standards and EBRD Performance Requirements. Portfolio includes a mix of solar PV and wind projects. Site audits were undertaken in August 2019. Bird monitoring and mitigation protocol was reviewed for the Tres Mesas 3 and 4 wind farms.

Desert Solar 50 MW Solar PV, Lenders E&S Advisor, EBRD, Sainshand, South Gobi, Mongolia (2017-2018)

Environmental advisor to EBRD ensuring project compliance with Equator Principles and EBRD Performance Requirements. Site visit undertaken to the site. Reviewed ecology, social, transport, archaeology, and stakeholder engagement.

ESDD Canadon Leon Wind Farm, OPIC, Argentina (2019)

Project managed the full ESDD of the Canadon Leon Wind Energy Project including site reconnaissance. Led project team and undertook site visit, conducted interviews with Sponsor and local communities, and reviewed relevant Project documentation. Gap Analysis and ESAP prepared to ensure compliance with Equator Principles and IFC Performance Standards prior to financial close, start of construction and during operation.

Masrik-1 Solar PV, Lenders E&S Advisor, EBRD and IFC, Armenia (2019)

Environmental advisor to IFC and EBRD for a solar power project. Works including a site visit and review of the ESIA study including social impacts, delivery route, archaeology, and undertook stakeholder engagement activities. Project undertaken in accordance with Equator Principles, EBRD Performance Requirements and IFC Performance Standards.

IFC Environmental Health and Safety Guidelines for Wind Energy. World Bank Group, Worldwide (May 2013 – 2016)

Lead author of the revised EHS guidelines on behalf of the World Bank. The guidelines cover both onshore and offshore wind development. Undertook an initial review of the EHS Guidelines for their applicability and relevance, identifying any apparent gaps in information and prepared a new guidance document. Following on from this, consultation was undertaken with relevant stakeholders with feedback incorporated to into the revised guidelines. Guidelines published in Aug 2015. Webinar delivered in 2016.

Clean Energy Asia, Tsetsii Wind Farm (50MW), Mongolia (2014 – 2016)

Acted as Project Manager for Clean Energy Asia LLC for their 50 MW Tsetsii wind farm in South Gobi. Carried out ESIA site visit in October 2014 and prepared preliminary report. Bird surveys commenced with the winter 2014 season and a full year was carried out. Project reached financial close in 2015 and construction monitoring was undertaken. Project now operational.

FMO, Satara Wind Farm (96 MW), India (2012 – 2014)

Provided environmental support as part of the wider construction monitoring team for 96 MW wind farm in India. Ensured project compliance with Equator Principles and IFC Performance Standards. Initial site visit undertaken in June 2012 with construction monitoring continuing through 2013 and 2014, the most recent visit being undertaken in March 2014.

Clean Energy, Salkhit Wind Farm (50MW), Mongolia (2010 – 2014)

Acted as project Environmental Advisor for Clean Energy LLC for their 50 MW Salkhit wind farm during development and construction in extreme conditions. Initial site visits undertaken in January, May and Aug 2012. Construction monitoring commenced in June 2012. Further visits to undertake bat monitoring in 2013. Prepared method statements for storage/treatment of contaminated soils, disposal of cement washout. Managed preparation of ESIA for extension to the original project from 25 to 31 WTGs.

Publications

McAlister, G., 2017, General Principles of Onshore Wind Environmental Impact Assessment. Engineering & Technology Reference, Institution of Engineering & Technology. UK.

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McAlister, G., 2006, Applying Strategic Environmental Assessment. Estates Review, Vol. 1, October-November 2006, pp 84-85

FORM 5 (r.14(4))

nema
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NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT
CERTIFICATE OF REGISTRATION AS AN ENVIRONMENTAL IMPACT ASSESSMENT/ AUDIT EXPERT

Certificate No: NEMA/EIA/RC/2193

Application Reference No: NEMA/EIA/ER/4901

This is to certify M/s **GREG MCALISTER** of

Flat 4/1, 19 Randolph Gate, Glasgow, G11 7DQ. UK (Address) has been registered as an Environmental Impact Assessment Expert in accordance with the provisions of the Environmental Management and Coordination Act Cap 387 and is authorized to practice in the capacity of a Lead Expert/Associate

Expert/Firm of Experts (Type) **Lead Expert**

Expert Registration No: **8927**

Issued Date : **12/16/2016**

Signature

(Seal)

Director-General
The National Environmental Management Authority

P.T.O.

ISO 9001: 2008 Certified

FORM 7 (r.15(2))

nema
mazingira yetu | uhai wetu | wajibu wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/14569

Application Reference No: NEMA/EIA/EL/19681

M/S **Greg McAlister**
(individual or firm) of address

P.O. Box , Plaza 319 St Vincent Street Glasgow G2 5LD,UK

is licensed to practice in the

capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**

registration number **8927**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **3/24/2021**

Expiry Date: **12/31/2021**

Signature…..

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001: 2015 Certified

NameofProponent	ApplicationId	Firm	Date	Status
GREG MCALISTER	NEMA/EIA/EL/6470	INDIVIDUAL	1/4/2017	Issued
GREG MCALISTER	NEMA/EIA/EL/9323	INDIVIDUAL	1/3/2018	Issued
Greg McAlister	NEMA/EIA/EL/13227	INDIVIDUAL	2/21/2019	Approved
Greg McAlister	NEMA/EIA/EL/16955	Individual	6/3/2020	Issued
Greg McAlister	NEMA/EIA/EL/19681	Individual		

Associate Expert

Lillian C. Kipchumba, BSc
Environmental Project Assistant

Key skills
Environmental Impact Assesment and Audit
Health and Safety Audits
Risk assesments
Project Management
Research
Climate Change Policy
Monitoring and Evaluation

Years of professional experience
3

Years with AECOM
1.5

Education
Kenyatta University, BSc Environmental Studies (Env. Studies)

Registrations/Certifications
Environmental Impact Assesment and Audit (Associate) Reg. No: 11283

Training
Environmental Impact Assesment and Audit- Kenyatta University
Climate Change Policy, Budget and Planning- Kenya School of Government.

Language skills
English, Swahili

Nationality
Kenyan

Professional affiliations
Member- Environment Institute of Kenya

Lillian has three years of experience in environmental management and climate change. She is currently the Environment Project Assistant under the GNI^{plus} Programme in Kenya. She also supports the Africa Environment team on Environmental management and permitting projects. Key projects she is currently working on include EIA work for a cable project that spans the East Coast of Africa. Lillian has also previously worked on several Environmental Audits for key industries in Nairobi including Twiga Chemicals Industry, Younshen Developers Company Ltd and Mr. Green Africa.

Professional history

2019 November-present, Environment Project Assistant for GNI^{plus} Programme, AECOM.

2019 Jan- 2019 October, Climate Change Monitoring and Evaluation Assistant, Lifeskills Promoters

2018 August-2019 January, Environmental Consultant (EIA and Environmental Audit), Kenya Eco-Preneurs Company Limited

2017 May-2017 September- Intern, National Environmental Management Authority (EIA, EA Departments).

Selected project experience

GNI^{plus} Programme, Government of Kenya and Government of Germany, Kenya (Environment Project Assistant)
GNI^{plus} programme focuses on two sectors – forestry and water. AECOM along with Climate Policy Initiative and Pollination are part of a consortium (called GNI^{plus}), that have received funding the German International Climate Initiative (IKI) to provide the Government of Kenya with the best available policy, technical, financial, governance, and legal expertise to support the implementation of its Nationally Determined Contribution (NDC). It is a three-year program working in partnership with the Ministry of Environment and Forestry, through the Climate Change Directorate (CCD), and in collaboration with the National Treasury and relevant sectoral ministries and other public and private stakeholders. GNI^{plus} is providing expert legal, technical and financial advice to:

- Support the creation of enabling environments to scale up public and private investment;
- Build bankable low-carbon and climate-resilient project pipelines;
- Improve governance and transparency through the creation of robust and enforceable regulations
- Support clear decision-making procedures that provide investor confidence; and
- Build national capacity.

Lillian is the Project Assistant and has contributed to research and development of the water and forestry readiness briefs that are important in highlighting the current water and forestry situations in the country and providing areas for opportunities and development in the sectors. Other roles include supporting in research and developing reports for the Payment for Ecosystem Service, surface and groundwater monitoring projects.
Date: 2018-Ongoing **Value:** EUR 8,000,000

Submarine Cable Project, Confidential Client, East-Africa (Environmental Impact Assessment)
Lillian is leading the Kenya team in the EIA process of laying the submarine cable. She has also supported the development of the Permit Feasibility Study, technical research and public participation activities.

Date: 2020-Ongoing **Value:** Not Available
Client contact: Not Available

Jeddah Stormwater Management Plan Project

Lillian worked with AECOM South African Environmental team to prepare a high-level assessment of the outfall locations and pumping stations for a stormwater project in Jeddah Saudi Arabia, by developing the environmental baseline section of the Preliminary Environmental Review.

Date: September 2020 **Value:** Not Available

Climate Change Fund Project, DFID, Western Kenya (Monitoring, Evaluation and Learning Assistant)
Key roles for the climate change finance project include:

- Collecting, analysing and documenting data from both counties on climate change: adaptation/mitigation measures, awareness and finance.
- Monitoring and evaluation: Monitoring of the two government's budgetary allocations for climate change and climate change adaptation/ mitigation projects in their County Integrated Development Plans and other county planning documents.
- Tracking and reporting on the level of integration and mainstreaming of climate change into the county planning processes. (Reviewing County Integrated Development Plans and County Annual Development Plans)
- Climate Change and environmental awareness to the county government officials and general public in the two western Kenyan counties.
- Documenting lessons learnt, best practices, case studies and other results-based documentation.
- Collaborating with the County legal departments to support the two County Governments in drafting county climate change act and CCCF fund regulations that would enable the counties access climate funds.

Date: January 2019- October 2020 **Value:** Not Available

Environmental Impact Assessment and Audit Consultant- Kenya Eco-Preneurs Limited
Key roles in the project include:

- Conducting EIA according to the Environmental Management and Co-ordination Act (EMCA, 2015) for construction projects and writing reports for submission to NEMA.
- Conducting Environmental Audit for industries including Twiga Chemicals, Younshen Developers Ltd and Mr. Green Africa. The audits included an assessment of:
  - ❖ Air quality, noise and vibration levels, water and energy consumption, waste management, hazardous waste handling such as asbestos.
  - ❖ Safety audit of the workplace which involved assessing the use of Personal Protective Equipment, health records of workers, risk assessment, chemicals used, signs and labels installed, safety policies, inspection of fire extinguishers, alarms and emergency exits and machinery maintenance.
  - ❖ Workplace accidents.
- Providing recommendations (Environmental Management Plans) that the industries could implement.
- Submitting air quality and fire safety reports to the Directorate of Occupational Safety and Health Services (DOSH).

Date: August 2018**-** January 2019

Stakeholder engagement specialists CVs (Norken)

1 CURRICULUM VITAE OF EXPERTS

Curriculum Vitae - Environmental Safeguards Expert

PROPOSED POSITION	Environmental Safeguards Expert
NAME OF STAFF	Isaiah Kegora
PROFESSION	Environmental Scientist
DATE OF BIRTH	18 October 1974
NATIONALITY	Kenyan

EDUCATION:

Qualification	Institution	Year
Master of Philosophy in Environmental Studies	Moi University	2004
Bachelor of Environmental Science	Kenyatta University	1999

MEMBERSHIPS OF PROFESSIONAL BODIES

Organization	Class of Membership	Abbreviated Title	Year of Registration	Membership No.
Environment Institute of Kenya	Lead	Lead EIA/EA	2007	1893
National Environment Management Authority	Lead	Lead EIA/EA	2007	1893

KEY QUALIFICATIONS:

Isaiah has developed an environmental consulting background in environmental impact assessment, and environmental, health and safety audit. He has over ten years' experience in environmental assessment and auditing. He has undertaken several EIA Studies, Environmental audits, health and safety audits for wide spectrum of clients including oil and gas, mining, power generation, manufacturing industries, and infrastructure among others. Additionally, he has been involved in environmental site assessments (Phases I, II & III) for oil and gas and manufacturing facilities.

Country Specific Experience

Isaiah has been involved in projects within the following countries:

- Kenya
- Mozambique
- Tanzania
- Uganda
- Zimbabwe

SELECTED PROJECT EXPERIENCE –ENVIRONMENTAL IMPACT ASSESSMENT:

Project: Proposed Kenya Off-Grid Solar Project (KOSAP) **Client:** Ministry of Energy **Location:** Turkana, Samburu, Mandera, Garissa, Kwale, Kilifi, Lamu, Narok, Isiolo, Wajir and Marsabit **Date:** Ongoing	**Description:** The Ministry of Energy of Kenya with the support of the World bank is proposing to develop 152no. Mini-Grid sites. ESIA, SA and VMGP are being conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 and WB/IFC environmental and social sustainability guidelines to determine the viability of the proposed Project and obtain approval from NEMA and the Lenders. **Role on Project:** - Team Leader
Project: Proposed Development of Small Hydropower Plants in Mt. Kenya **Client:** Helios Group **Location:** Muranga, Embu, Meru, Kiambu **Date:** Ongoing	**Description:** Helios Group is proposing to develop 5no. small hydropower projects. ESIA is being conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 and WB/IFC environmental and social sustainability guidelines to determine the viability of the proposed Project and obtain approval from NEMA and the Lenders. **Role on Project:** - EIA Lead
Project: Proposed Development of Nairobi-Nakuru-Mau Summit Road **Client:** Rift Valley Highways Limited **Location:** Nairobi, Narok, Nyandarua and Nakuru Counties **Date:** Ongoing	**Description:** Rift Valley Highways Limited together with Government through a public private partnership (PPP) are proposing to widen, improve, operate and maintain various sections of the Nairobi-Nakuru-Mau Summit Road. ESIA is being conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 and IFC environmental and social sustainability guidelines to determine the viability of the proposed Project and obtain approval from NEMA and the Lenders. **Role on Project:** - EIA Lead
Project: Environmental and Social Management Framework and Resettlement Policy Framework for Priority Urban Roads **Client:** United Nations Office for Project Services (UNOPS) **Location:** Muranga, Embu, Meru, Kiambu **Date:** March 2019-June 2019	**Description:** United Nations Office for Project Services (UNOPS) with the Funding from the World Bank contracted Norken International Limited to prepare Environmental and Social Management Framework (ESMF) and Resettlement Policy Framework (RPF) for Priority Urban Roads in Baidoa and Kismayo Municipalities, Somalia. **Role in the Project**: Project Manager

Project: Proposed Development of Isiolo-Lokichar Road Project **Client:** Kenya National Highway Authority **Location:** Isiolo, Meru and Turkana Counties **Date:** Ongoing	**Description:** KeNHA is proposing to construct Isiolo-Lokichar Road to bitumen standard. ESIA and RAP are being conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 and WB/IFC environmental and social sustainability guidelines to determine the viability of the proposed Project and obtain approval from NEMA and the Lenders. **Role on Project:** - ESIA/RAP Project Manager
Project: Proposed Development of Isiolo-Lokichar Road Project **Client:** Kenya National Highway Authority **Location:** Isiolo, Meru and Turkana Counties **Date:** Ongoing	**Description:** KeNHA is proposing to construct Isiolo-Lokichar Road to bitumen standard. ESIA and RAP are being conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 and WB/IFC environmental and social sustainability guidelines to determine the viability of the proposed Project and obtain approval from NEMA and the Lenders. **Role on Project:** - ESIA/RAP Project Manager
Project: Proposed Upgrade and Extension of Water and Sewerage Lines **Client:** Nyeri Water and Sanitation Company **Location:** Nyeri County **Date:** 2018	**Description:** Nyeri Water and Sanitation Company Proposes to upgrade water lines and extend sewerage services to unserved areas within their service area. ESIA was conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 and IFC, WB and AfDB environmental and social sustainability guideline to determine the viability of the proposed Project and obtain approval from NEMA and Lenders. **Role on Project:** - Lead EIA Expert
Project: Nairobi Satellite Towns Water and Sanitation Development Programme, Phase 1- Ruiru-Juja and Ongata Rongai-Kiserian Water Supply Project **Client:** Athi Water Services Board **Location:** Kiambu and Kajiado Counties **Date:** 2017 to date	**Description:** AWSB Proposes to extend existing water supply systems and connect non-connected areas to the water supply system in Ruiru-Juja areas of Kiambu County and Ongata-Rongai of Kajiado County. ESIA was conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 and IFC, KfW,WB and AfDB environmental and social sustainability guideline to determine the viability of the proposed Project and obtain approval from NEMA and Lenders. **Role on Project:** • Project Manager for ESIA and RAP for Ruiru-Juja Water Project • Project Manager for ESIA and RAP as well as Lead EIA Expert for-Kiserian-Ongata Rongai Water Project
Project: Proposed Construction of Water Dam **Client:** Shanta Gold Mine **Location:** Mbeya Tanzania **Date:** 2014-2015	**Description:** Shanta Gold Mine proposed to construct a dam on Luika River to supply water to its Gold Mine. ESIA was conducted in accordance with the IFC environmental and social sustainability guidelines to determine the viability of the proposed Project and obtain approval from National Environment Management Council and the Lenders. **Role on Project:** - Lead EIA Expert

Project: Proposed Construction of Nairobi-Mombasa Express Way **Client:** Betchtel/KeNHA **Location:** Nairobi- Mombasa **Date:** 2018	**Description:** Kenya National Highway Authority has contracred Bechtel, an American Firm to develop the proposed Nairobi-Mombasa Expressway. Betchel in turn engaged ERM with the assistance of Norken International (Sub-Consultant) to under ESIA in accordance with the Kenyan legislations as well as World Bank environmental and social sustainability guidelines to determine the viability of the proposed Project and obtain approval from National Environment Management Authority and the Lenders. **Role on Project:** - Project Manager for the sub-consultant team involved in Baseline Biodiversity and Social Studies for ESIA for the proposed project.
Project: Proposed Construction of 15 Markets, 10 Railway Stations and a Sanitary Landfill **Client:** Ministry of Transport, Infrastructure and Housing and Urban Development **Location:** Nairobi, Kiambu, Machakos, Kajiado and Muranga Counties **Date:** 2015-2017	**Description:** The Ministry of Transport, Infrastructure and Housing and Urban Development through Nairobi Metropolitan Services Improvement Project proposed to construction Markets, Railway Stations and Landfill Facilities within Nairobi Metropolitan Area. ESIA was conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 and World Bank environmental and social sustainability guidelines to determine the viability of the proposed Project and obtain approval from NEMA and the World Bank. **Role on Project:** - Lead EIA Expert
Project: Revamping of GAPCO Terminal 2 **Client:** Total Kenya PLC **Location:** Shimanzi, Mombasa County **Date:** 2018	**Description:** Total Kenya PLC is proposing to modify the existing storage tank farm at GAPCO Terminal 2 and convert 2no. tanks from single to double skin tanks used them to store PMS. An ESIA was conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 and IFC's Performance Standards, to determine the viability of the proposed Project. **Role on Project:** - Lead EIA Expert and Project Manager
Project: Early Oil Pilot Scheme **Client:** Kenya Petroleum Refineries Limited **Location:** Changamwe, Mombasa County **Date:** 2016	**Description:** The Government of Kenya proposed to introduce Crude Turkana Oil to the world market. In order to this, an Early Oil Pilot Scheme was proposed which involved developing storage and export facilities at Kenya Petroleum Refineries Limited. An ESIA was conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 and IFC's Performance Standards, to determine the viability of the proposed Project. **Role on Project:** - EIA Expert
Project: Proposed Installation of LPG Tanks and Filling Stations **Client:** Total Kenya Limited **Location:** Nairobi and Thika **Date:** 2013	**Description:** Total Kenya Limited was contracted by British America Tobacco to install LPG Tanks and Filling Stations at their Tobacco Lea Threshing Facility in Thika and Tobacco Factory in Nairobi. EIA Project Reports were conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 to determine the viability of the proposed Project and obtain approval from NEMA. **Role on Project:** - Lead EIA Expert
Project: Proposed Installation of Petroleum Oil storage tanks **Client:** Libya Oil Limited **Location:** Nairobi, Kisumu and Eldoret **Date:** 2013	**Description:** Libya Oil Limited Proposed to install additional underground fuel oil storage tanks in 3No. service stations in Nairobi, Kisumu and Eldoret. EIA Project Reports were conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 to determine the viability of the proposed Project and obtain approval from NEMA. **Role on Project:** - Lead EIA Expert

Project: Proposed Construction of Service Station **Client:** Gulf Energy **Location:** Nanyuki Town **Date:** 2013	**Description:** Gulf Energy Limited Proposed to construct a service station in Nanyuki Town. EIA Project Report were conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 to determine the viability of the proposed Project and obtain approval from NEMA. **Role on Project:** - Lead EIA Expert
Project: Proposed Construction of Vegetable Oil Storage Terminal **Client:** Gulf Stream **Location:** Shimanzi, Mombasa **Date:** 2009	**Description:** Gulf Stream Limited Proposed to construct a bulk vegetable oil storage terminal in Shimanzi, Mombasa. ESIA Project Report were conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 to determine the viability of the proposed Project and obtain approval from NEMA. **Role on Project:** - Lead EIA Expert
Project: Proposed Development of 90MW Wind Power Project **Client:** Mpeketoni, Lamu **Location:** Nyeri County **Date:** 2015-todat	**Description:** Elicio NV proposed to developed 90MW Wind Power Project in Mpeketoni Lamu County. ESIA was conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 and IFC environmental and social sustainability guidelines to determine the viability of the proposed Project and obtain approval from NEMA and the Lenders. **Role on Project:** - Lead EIA Expert

Languages:

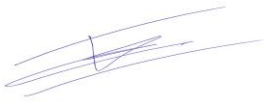
	Speaking	**Reading**	**Writing**
English	Excellent	Excellent	Excellent
Kiswahili	Excellent	Excellent	Excellent

EMPLOYMENT RECORD:

Year	Company	Position
2017 to Date	Norken International Limited	Head of Environment Department
2009 – 2014	SGS Kenya Limited	Environment, Health and Safety Auditor
2014-2017	SGS Kenya Limited	Operations Manager/Head of Consulting Services
2007-2009	Nutek Solutions Limited	Environment, Health and Safety Advisor
2004 – 2007	AMI Development Services	Research Assistant

Certification:

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes myself, my qualifications, and my experience, and I am available to undertake the assignment in case of an award.

Name of Expert Isaiah Kegora Signature 

FORM 7 (r.15(2))

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mazingira yetu | uhai wetu | wajibu wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/14175

Application Reference No: NEMA/EIA/EL/18926

M/S **Isaiah B. Kegora**
(individual or firm) of address

P.O. Box 860, Kericho is licensed to practice in the

capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**
registration number **1893**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **2/25/2021** Expiry Date: **12/31/2021**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001 BUREAU VERITAS Certification

ISO 9001: 2008 Certified

SOCIAL SAFEGUARDS SPECIALIST

Name	**:**	Joyce Akinyi Owino
Nationality		Kenyan
Telephone		+254 0723 584 543
Email		joywino@gmail.com

Key Qualifications:

- Ten years' experience in Environmental and Social Governance due diligence in the realms of small and large scale infrastructure developments;
- Experienced in delivering global best practice E&S work (i.e. IFC Performance Standards) in emerging markets;
- Effective organizational skills, including the ability to prioritize processes and schedules, develop sound project plans, conduct constructability, operability, maintainability reviews and juggle multiple assignments with competing deadlines;
- Experienced in conducting Social Impact Assessments (SIA);
- Experienced in Strategic Environmental Assessment (SEA) and Social Assessment Studies;
- Experienced in carrying out Socio-Economic Baseline Surveys;
- Knowledge in preparation of Stakeholder Engagement Plans (SEP);
- Experienced in working with Indigenous People and preparing relevant Indigenous People Framework;
- Experienced in preparation of Resettlement Action Plan and Resettlement Planning Frameworks; Experienced in preparation of Grievance Redress Mechanism Designs and Implementation;
- Experienced in public consultation and community involvement of development projects; Knowledge of design and implementation of baseline surveys;
- High level of intellectual curiosity with the ability to work independently in a self-directed, entrepreneurial environment;
- Ability to excel in a collaborative, technical, cross-functional and geographically diverse organization;
- Ability to work well in rural environments and collaborate with rural communities across East Africa;
- Ability to travel regionally on a frequent basis to project sites;
- Experienced in preparation of timely project proposals, company presentations and reports of diverse development projects;
- Experienced in carrying out needs assessment in project implemented areas and tailor implementation programs based on each community's unique needs;
- Experienced in carrying out social monitoring and evaluation of development projects to report on key indicators and recommend corrective measures where needed; .and
- In depth understanding of data analysis. That is descriptive statistics, exploratory data analysis, and confirmatory data analysis.

Education:

University of Nairobi
2018-Ongoing
Masters of Arts (Sociology)

Kenyatta University
2007-2011
Bachelor of Science: (Community Resource Management)

Employment Record:

Position held: Senior Graduate Social Environmentalist
Date: 2013 Nov to February 2019
Employer: GIBB Africa Ltd
Location: Kenya

Position held: Stakeholder and Community Development Expert
Date: 2012 Feb to Sept 2013
Employer: Design Master Plan Ltd
Location: Kenya

Experience:

Jan 2021- Ongoing **Short Term Consultancy at Rise Sustainability Consulting for the SunFunder Gender activities:** SunFunder requires support with strengthening its work in gender equality based on a Gender Policy and Gender Action Plan (GAP). The main objectives and purpose of the assignment is to support SunFunder with completing and implementing GAP tasks in order to build an overarching to framework integrate gender considerations into project analysis during due diligence and monitoring of downstream borrowers (e.g. developers in solar energy). This includes capacity development within SunFunder and is aimed at bridging SunFunder's capacity gap in this field of expertise to meet gender related objectives.

Nov 2020-Ongoing **Short Term Consultancy at Rise Sustainability Consulting: Feasibility Study and Preparation of Conceptual Designs of Bridges at Various Ferry Crossing Points in Sierra Leone.** The Client AETS have established a consortium, including Cardno Emerging Markets and independent consultants, to undertake a Preliminary Environmental and Social Impact Assessment (PEIA) and Preliminary Resettlement Action Plan (PRAP) in relation to the construction of 6 bridges with approximately 200 meter approach roads on either side. The purpose of the project is to eliminate the need for ferry crossings that are deemed unsafe for users and to improve access.

Oct 2020-Ongoing **Short Term Consultancy at Frame Consultants Ltd as Project Sociologist for Environmental and Social Impact Assessment and Resettlement Action Plan Studies for the Proposed Oloolotikosh-Kitengela ,Kajiado Water and Sewerage Project In Kajiado County.** The Client AWWDA /TAWWDA is implementing projects financed under Kenya Towns Sustainable Water Supply and Sanitation Program financed by AfDB, The proposed Olooloitikosh Dam project is among the sub-projects expected to benefit from the funding with the goal to provide adequate and sustainable water supply to Kitengela Town, Kajiado Towns and their environs. The proposed dam, after its implementation, will harness runoff waters and thereafter make them available for domestic and irrigation use, with the aim of achieving food security and poverty reduction.

October 2020- **Short Term Consultancy at Norken International Ltd as Stakeholder Engagement Specialist for the 2Africa Submarine Fibre Optic Cable Network Permit Feasibility Study (PFS) for Landing Site at Mombasa, Kenya Project.** The PFS is intended to provide the project's developers with information on the project's environmental and social sensitivities and permitting requirements to inform the project's design and schedule planning. My task as the Stakeholder Engagement Expert was to prepare a stakeholder engagement plan and assist the client in identifying the

stakeholders responsible for issuing environmental permits and approvals that are required prior to the installation and operation of the cable system, consulting the stakeholders on approval processes, dependencies between permit processes and required supporting documentation and hold meetings with key stakeholders, to confirm processes for permits and approvals. Through this process, confirm the required content of permit application documents, scope of environmental assessments and other required studies, and report writing.

Oct 19-October 20 **Short term Consultancy at Centric Africa Ltd as Social Safeguards Specialist/ Stakeholder Engagement Lead for Nairobi Expressway Project**
(GoK), through the Kenya National Highways Authority (KeNHA), in its ambition to mobilize private sector capital and expertise in the infrastructure space has partnered with China Roads and Bridges Corporation to implement the first Public, Private Partnership (PPP) under the Build Operate Transfer (BOT) Model, which will be the first BOT model project in Kenya. Stakeholder engagement is a key aspect of the ESIA process. It will provide an opportunity for various groups, including the government and potentially affected communities to express their views and concerns, as well as participate in the design of the project to minimize negative impacts as much as possible and enhance positive impacts. As the stakeholder engagement lead, am responsible for planning, organizing, facilitating and document all aspects of stakeholder engagement forums as well as monitoring of environmental and social issues related to the proposed project. Prepare a Stakeholder Engagement Plan (SEP) that will ensure meaningful engagements with all the relevant project stakeholders during the construction phase, to ensure contractors involved in all aspects of the project construction are compliant with ESMS, project-specific ESMP, and Health and Safety best practices. The SEP will also be used during the operations phase to ensure compliance with ESMS and project-specific ESMP including ensuring environmental audits are carried out as required by local and international law;

Sept 18 to Feb 19 **Assisting Socio Due Diligence Expert for the Consultancy Services for Environmental and Social Baseline Survey, Stakeholder Engagement Plan (SEP) for Barrier Volcanic Complex (BVC) Geothermal Project in Turkana, Kenya.**
The Client (Olsuswa Energy Limited) intended to establish the bio-physical and socio-economic conditions on the 136 km^2 of the BVC Geothermal Project in compliance with the Kenya statutory requirements and International Financing Institution's (IFC) environmental and social safeguards as a prerequisite to the Project development. The Stakeholders' (Community) Engagement Plan (SEP) was to be developed to ensure meaningful and inclusive stakeholder participation throughout the project lifecycle. My duties involved coordinating the social team in Identify project E&S risks and impacts, conducting socio- economic baseline survey at household level of persons living in close proximity to the calderas and consultation with the community and relevant representatives of existing stakeholder groups to design the SEP that would be culturally appropriate and in compliance with IFC Performance Standards.

May 18 to Oct 18 **Assisting Social Due Diligence Expert for Consultancy Services for the Preparation of Environmental and Social Safeguard Documentation for The Geothermal Projects & Water Abstraction Infrastructure in Baringo-Kenya.**
The Client (Geothermal Development Company) required us to align the individual existing ESIA documentation for the Baringo Water Infrastructure

Project and Korosi, Paka and Silali Geothermal Projects with the requirements of the national legislation and the applicable IFC performance standards, along the provisions of the respective environmental and social action plans. My duties included screening associated facilities for each of the projects in order to update the Environmental and Social Management Plans (ESMPs) for specific sites (Korosi, Paka and Silali Projects as well as Baringo Water Infrastructure Project) and include all necessary Environmental and Social (E&S) Management Sub-Plans. Where appropriate joint E&S Management Sub-Plans were to be provided, prepare a Stakeholder Engagement Plan, including an Indigenous Peoples Plan (if applicable) as well as an overall Land acquisition and Compensation Framework to cover the general provisions for all the four projects and to prepare a Community Development Framework, comprising of GDC's approach outlining feasible support measures for local communities in the three Project areas and in the area of the Baringo Water Abstraction Project.

Mar 18 to Jan 19 **RAP Expert for the Update of the Designs for Wajir- Kutulo Roads Project in Wajir and Mandera in Kenya, which is part of the North Eastern Transport Improvement Project (NETIP).**

The rationale of the project was founded on the realization that poor road access to the North Eastern part of Kenya constrains the social and economic development prospects of the area. The region is marginalized geographically and is historically underserved. The Client is Kenya National Highway Authority. The project is World Bank funded and it tasks included a human rights based approach, to respect the right to Free Prior Informed Consent when .conducting public participation, stakeholder engagements, community empowerment and capacity building forums on issues of involuntary resettlement for the Project Affected Persons (PAPs) who were within the right of way of the proposed road alignment from Wajir town to Kutulo in Mandera County (119KM). Resettlement Action Plan (RAP) Report was prepared in accordance with World Bank standards

Jan 18 to Mar 18 **Stakeholder Engagement/RAP Expert for Consultancy Services for ESIA and RAP Studies for Marua-Nanyuki-Lewa (A2) road.**

The services include preparation of ESIA and RAP Reports in accordance with the AfDB standards as well as preparing a Gender Analysis Report for the Project.

Dec 17 to Feb 19 **Social Environmentalist for Gender Mainstreaming for the Transport Sector in Kenya.**

The client is Kenya National Highways Authority. The project sponsored by AfDB includes preparation of a strategy, action plan, guidelines, indicators, toolkits and checklists for use in preparation, design, implementation and monitoring of gender responsive programming in the road sub-sector. Activities Performed: Project coordination and provision of inputs into social safeguards required in each of the assignment outputs.

April 17 to Feb 19 **Assistant Community Development and Mobilization Expert. In the planning of Nairobi Central Railway Station and its surrounding.**

The project entailed strategies to revitalize the Central Business District (CBD) and the adjacent areas and showing linkages with other sub centres in Nairobi as proposed in the Nairobi Integrated Urban Plan (NIUPLAN). The integrated nature of this plan necessitates that participatory multidisciplinary and multi sectoral approaches are deployed to ensure the project's success.

Engage the public in consultation process that shall entail surveys, design workshops and other forms of involvement in the urban design; Incorporate public participation in the urban design activity in order to improve the fit between design and needs of the public; Allow more effective use of

resources by providing informed direction for decision making; Offer time or cost savings during the decision-making process by encouraging increased public support for positive change; Develop a greater sense of public ownership over changes, legitimise public interests and enhance a sense of community and collective vision for the Nairobi City Centre; and Participate in visioning activities which shall be carried out after initial mapping is complete and preparation of extensive materials to enable stakeholders to participate actively.

August 16 to Jan 18 **Assistant Social Development Specialist for the Development of a Community Engagement Framework for Power Africa**
This was a USAID Project that involved a wide range of consultations and analysis in order to come up with a framework for genuine community engagement, based on a genuine partnership between communities, government and the power development sector that engages all parties in an open, transparent, accountable and sustainable process from the initial design concept through to implementation. It was published by the USAID Power Africa Project team in January 2018 and is available online at **www.usaid.gov/powerafrica.kenya**

Nov 14 to Jan 15 **Community Engagement/RAP Expert for the Resettlement Action Plan for the proposed storm water drainage facilities project for Malindi town for the Ministry of Local Authority under the KMP programme.** This involves carrying out a Resettlement Action Plan (RAP) In accordance with World Bank Guidelines in the project area. Funded by World Bank

Sept 14 to Oct 14 **Social Environmentalist during the update of valuation for the supervision of works for the Nairobi River's sewerage improvement project (NarSIP)**

July 14 to Sept 14 **Community Engagement/RAP Expert-Development of a Resettlement Action Plan (RAP) for Keroka Water Supply and Sanitation Project**
The study entailed identification of Project Affected People within the Intake and the Pipeline Reserve, conducting of household surveys and Socio-economic surveys, valuation of affected property, community mobilization, sensitization and stakeholder consultation, GIS Mapping and identification of negative impacts of the project, development of mitigation measures and a monitoring & evaluation plan for the RAP.

June 14 to Dec 14 **Phase II Preliminary Design Study of the Dar es Salaam-Isaka-Kigali/Keza-Musongati Railway (Tanzania-Rwanda-Burundi)**
The study entailed identification of project boundaries by the use of GPS, Stakeholder consultations, Community Mobilization and Sensitization, Conducting a census on Project Affected People (PAPs) within the proposed wayleave for acquisition in Tanzania, Rwanda and Burundi and railway reserve within the operational section of the line (Dar to Isaka). Other activities conducted include Asset Survey and Valuation of affected property and conducting of Social Impact Assessment studies. Output of the study was ESIA and RAP reports.

Client : Rwanda Transportation Development Agency (RTDA)
Responsibility : Assisting Sociologist and RAP Expert

May 14 to Aug 14 **Development of a Resettlement Action Plan (RAP) for Rift Valley Railways on Tororo – Pakwach Railway Line, Uganda**
The study entailed identification of Project Affected People within the Railway Reserve, conducting of household surveys and Socio-economic surveys,

valuation of affected property, community mobilization, sensitization and stakeholder consultation, GIS Mapping and identification of negative impacts of the project, development of mitigation measures and a monitoring & evaluation plan for the RAP. The project covered a total 502 kilometres traversing 17 districts in the Northern Region of Uganda starting from Tororo to Nebbi district.

Client : Rift Valley Railways
Responsibility : RAP Specialist

May 14 to June14 **Social Environmentalist for Sio-Malakisi Irrigation Project,** Duties entail additional consultations during the full Environment and Social Impact Assessment (ESIA) study phase to document the environmental and social impacts of the project and general community perceptions on the final project designs.

Feb 14 to Mar 14 **Social Environmentalist for Kiboko Uamani Irrigation Project.** Duties included; Assessment of potential impacts of the Project on the bio-physical and socio-economic environment; Conducting wider and detailed consultations with all interested and affected parties and the relevant authorities; Determining the environmental and socioeconomic sustainability of the project; and Designing appropriate impacts mitigation, management and monitoring measures.

Nov 13 to Jan 14 **Community /Stakeholder Engagement Coordinator for the Development of the Integrated Urban Development Master Plan for the city of Nairobi. Technical Assistance for Strategic Environmental Assessment.** The activities involve conducting public meetings in all the 9 sub counties, baseline studies, Focus Group Discussions, organizing for workshops and report writing

Jan 13 to Sept 13 **Community Development Expert: for Badasa Clusters irrigation Development Project by National Irrigations Board (NIB).** The main task was: 'to assess the extent and viability of opportunity for investment in irrigated agriculture within the Badasa Cluster of Marsabit County. Specific

Nov 12 to Sept 13 **Community Development Expert: conducting a detailed social impact assessment study for development of Lowaat Dam in Kerio River Basin Project in Kenya by the National Irrigations Board (NIB).** The development of the dam would make it possible for the local communities to draw economic benefits from the water resource of Kerio River.

Feb 12 to May 13 **Community Development Expert: for the Bondo Cluster Irrigations Project:**Duties involved Community mobilization and sensitization gender analysis, conducting a socio-economic baseline survey, Formation of Water Users Association, development of by-laws, training the community on organization, and scheme leadership and establishment of an Interim Scheme.

September 2011 **Implementation of Rift Valley Railways Resettlement Action Plan (RAP) training (World Bank, FMO, PROPACO, KfW, Equity Bank and African Development Bank funded project)** The task involved training Community Liaison Officers from the Rift Valley Railways headquarters of Uganda and Kenya on World Bank and African Development Bank Policies on Involuntary Resettlement. RAP implementation activities, tools for public consultations and disclosure during implementation of Resettlement Action Planning, monitoring and evaluation of resettlement activities.

Client : Rift Valley Railways
Responsibility : Intern training and supervising Enumerators collecting RAP Baseline Data

Languages:	Speaking	Reading	Writing
English	Excellent	Excellent	Excellent
Kiswahili	Excellent	Excellent	Excellent

Curriculum Vitae

Loise Muthue Kioko

Tel: 0719335653

lkioko@norken.co.ke

Kenyan

Employment:

2017 – Ongoing	**:** Norken International Limited (Assistant Environmentalist)

Education:

2018 – Ongoing	**:** MSc. Environmental and Biosystems Engineering, Environmental Engineering Option (University of Nairobi)
2011- 2016	**:** BSc. Biosystems Engineering, University of Nairobi (Award: Upper Second Class Honours)

Other Skills and Certification:

Languages	English-fluent, Swahili-fluent
Certification	From Climate Science to Action by The World Bank Group on Coursera. Certificate earned at Monday, June 5, 2017 11:12 AM GMT". https://www.coursera.org/account/accomplishments/certificate/DYR8G77JQ6DH ISO 9001:2015- Quality Management Systems Internal Auditor

Registration

- Environmental Institute of Kenya (EIK)
- A registered National Environmental Management Authority **Associate Expert**, Reg. No. 8993

Project Experience:

Period	**Client**	**Project**	**Roles and Responsibilities**
Ongoing	Ministry of Energy	Proposed Kenya Off-Grid Solar Project (KOSAP) **Location:** Turkana, Samburu, Mandera, Garissa, Kwale, Kilifi, Lamu, Narok, Isiolo, Wajir and Marsabit counties The Ministry of Energy of Kenya with the support of the World bank is proposing to develop 152no. Mini-Grid sites. ESIA, SA and VMGP are being conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 and WB/IFC environmental and social sustainability guidelines to determine the viability of the proposed Project and obtain approval from NEMA and the Lenders.	**Assistant Environmentalist** - Environmental Impact Assessment - Stakeholder consultations and engagement
Ongoing	Rift Valley Highways Limited/ WSP Canada	Proposed Development of Nairobi-Nakuru-Mau Summit Road (Kiambu, Nyandarua, Baringo and Nakuru Counties) Rift Valley Highways Limited together with Government through a public private partnership (PPP) are proposing to widen, improve, operate and maintain various sections of the Nairobi-Nakuru-Mau Summit Road. ESIA is being conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 and IFC environmental and social sustainability guidelines to determine the viability of the proposed Project and obtain approval from NEMA and the Lenders.	Stakeholder consultations and engagement
October 2019-December 2019	Kenya Water Towers Agency	Environmental and Social Impact Study for the proposed Electric Fencing of Maasai Mau Forest	**Assistant Environmentalist** - Environmental Impact Assessment - Stakeholder consultations and engagement
June 2019	United Nations High Commissioner for	Environmental Audit of the UNHCR Kakuma Refugee Camp and Kalobeyei Settlement	**Environmental Auditor** - Assessment of existing environmental practices against legal and policy

Period	**Client**	**Project**	**Roles and Responsibilities**
	Refugees (UNHCR)		requirements - Stakeholder consultations and engagement
May 2019	Tullow Kenya BV	Environmental Audit of Kapese IOB and Seismic Exploration Activities of Block 10BB	**Environmental Auditor** - Assessment of existing environmental practices against legal and policy requirements - Stakeholder consultations and engagement
September 2018 - Ongoing	Helios Group	**Proposed Development of Small Hydropower Plants in Mt. Kenya (**Muranga, Embu, Meru, Kiambu counties) Helios Group is proposing to develop 5no. small hydropower projects. ESIA is being conducted in accordance with the EMCA, 1999, EIA/EA Regulations 2003 and WB/IFC environmental and social sustainability guidelines to determine the viability of the proposed Project and obtain approval from NEMA and the Lenders.	**Environmentalist** Environmental and Social Impact Assessment
October 2018	Tullow Kenya BV	Environmental Audit of Block 13T	**Environmental Auditor** - Assessment of existing environmental practices against legal and policy requirements - Stakeholder consultations and engagement
March 2018	ERM/Bechtel Corporation	Environmental and Social Impact Assessment of the Proposed Nairobi - Mombasa American Expressway Kenya National Highways Authority has contracted Bechtel, an American Firm to develop the proposed Nairobi-Mombasa Expressway. Betchel in turn engaged ERM with the assistance of Norken International (Sub-Consultant) to under ESIA in accordance with the Kenyan legislations as well as World Bank environmental and social sustainability guidelines to determine the viability of the proposed Project and obtain approval from National Environment Management Authority and the Lenders.	**Assistant Sociologist** Stakeholder Engagements as part of the Social Impact Assesment
Novemb	Tullow	Environmental and Social Impact Assessment	**Environmentalist**

Period	**Client**	**Project**	**Roles and Responsibilities**
er 2017	Kenya BV	Installation of Food Waste Composter at Kapese Operation Base	- Environmental Impact Assessment - Stakeholder consultations and engagement
August 2016 - Ongoing	Safaricom PLC	Construction of Base Transceiver Stations in Kenya (over 100 site locations)	**Environmentalist** - Environmental Impact Assessment - Stakeholder Engagement and consultation
August 2016-2018	Vivo Energy Kenya	Environmental and Social Impact Assessment for the Proposed Construction of New Shell Service Stations	**Environmentalist** - Environmental and Social Impact Assessment - Stakeholder Engagement and consultation
October-November 2016	Safaricom PLC	Environmental Audits of Retail Shops in Kenya	**Assistant Auditor** - Environmental, Occupational and Health Safety, Fire Safety and Risk Assessment Audit
December 2016	Vivo Energy Kenya	Environmental Audits of Depots and Terminals in: - Malindi Depot - Nairobi Terminal - Mombasa Terminal - Moi International Airport Depot - Moi Airbase Depot	**Assistant Auditor** - Environmental, Occupational and Health Safety and Fire Safety audits

Certification:

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe me, my qualifications, and my experiences

..... ……. Date: 9th June, 2021

Signature

FORM 7 (r.15(2))

nema

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/14558

Application Reference No: NEMA/EIA/EL/18832

M/S **Loise Kioko**
(individual or firm) of address

P.O. Box 9882-00100, Nairobi

is licensed to practice in the

capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Associate Expert**
registration number **8993**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **3/24/2021**

Expiry Date: **12/31/2021**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

Mohamed Omar Said

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OBJECTIVE

Achieve the sustainable management and conservation of coastal and marine landscapes

SKILLS

Marine ecosystem monitoring, coastal forest monitoring, management planning, species conservation strategies, wildlife census

EXPERIENCE

Principal Scientist –
Marine & Coastal Research Centre,
Wildlife Research and Training Institute
From July 2021 to Current

Responsibilities

- Planning, developing, implementing, and coordinating coastal and marine research programmes
- Coordinating establishment of coastal and marine protected areas ecological monitoring programmes and biodiversity databases
- Coordinating preparation and implementation of a long-term strategic plan for coastal and marine research that is aligned to the corporate strategic plan
- Coordinating development and implementation of national species recovery and action plans for rare and threatened species
- Identifying potential sources of funding for research and submitting proposals for funding.

KENYA WILDLIFE SERVICE
From 1999 to 2020

Principal Scientist – Coast Conservation Area (2018 -2021)

Head Ecological Monitoring, Bioprospecting and Data Management (2017 – 2018)

Head Wetlands and Marine Conservation (2015 – 2017)

Head Conservation Programmes - (2014 – 2015)

Senior Scientist – Coast Conservation (2006 – 2013)

Research Scientist – Coast Conservation Area (2005 – 2006)

Assistant Research Scientist – Coast Conservation Area (2003 – 2005)

Professional Experience and Achievements

- Ecological Monitoring of Coastal Marine Protected Areas
- Coastal Forests Ecological Monitoring in Shimba Hills National Reserve, Arabuko-Sokoke National Forest Reserve and Dodori National Reserve
- Mangrove Research in Mida Creek, Kilifi Creek, Marereni, Ngomeni, Kiunga and Tudor Creek,
- Endangered Species Conservation
- Development of the National Sable antelope Conservation and Management strategy

- Development of the National Coral reef Conservation and Management Strategy
- Developing Management Plans for Coastal and Marine Protected Areas
- Aerial census for both marine and terrestrial ecosystems
- Development of the World Bank/GEF funded KCDP Project Proposal

EDUCATION

Doctor in Sciences
Vrije Universiteit Brussel (Pleinlaan 2, B-1050 Brussels, Belgium),
Université Libre de Bruxelles (Avenue F.D. Roosevelt 50, B-1050 Bruxelles, Belgium),
Dissertation: Effects of Sewage Pollution and Wood exploitation on the Structure and Development of Mangroves Mombasa (Kenya)

Master of Science Ecological Marine Management
Vrije Universiteit Brussel (VUB – 'Free University of Brussels'), Pleinlaan 2, B-1050 Brussels, Belgium,
Universiteit Antwerpen (University of Antwerp), Groenenborgerlaan 171, B-2020 Antwerpen, Belgium
Dissertation: Field evaluation of metallothionein as a biomarker of metal exposure: the effects of energy reserves and condition

Bachelor of Science Degree (Biochemistry and Zoology)
Jomo Kenyatta University of Agriculture and Technology

VOLUNTEER EXPERIENCE OR LEADERSHIP

Taskforces and Committees
2016 Member of the Integrated National Maritime Policy Taskforce – Kenya Maritime Authority, Ministry of Transport
2015 Member of the Integrated Coastal Zone Management Steering Committee

2015 Member of the National Mangrove Technical Committee
2012 Member of the National Coral Reef and Seagrass Taskforce
2011 Member of the National Sea Turtles Taskforce
2009 Member of the State of the Coast Taskforce

National Focal Point to the Convention for Migratory Species (CMS)

- Memorandum of Understanding on the Conservation and Management of Marine Turtles and its Habitats of the Indian Ocean South East Asia
- Memorandum of Understanding on the Conservation of Dugongs and their Habitats in their Range
- Memorandum of Understanding on the Conservation of Migratory Sharks

Publications

2009 **Mohamed, M. O. S**., Neukermans, G., Kairo, J. G., Dahdouh-Guebas, F., Koedam, N. 2009. Mangrove forests in a peri-urban setting: the case of Mombasa (Kenya). Wetlands Ecology and Management 17:243–255

2009 Government of Kenya. 2009. State of the Coast Report: Towards Integrated Management of Coastal and Marine Resources in Kenya. National Environment Management Authority (NEMA), Nairobi. 88 pages.

2010 Munga C. N**., Mohamed M. O. S.,** Obura D. O., Vanreusel A. and Dahdouh-Guebas F. 2010. Resource Users' Perceptions on Continued Existence of the Mombasa Marine Park and Reserve, Kenya. Western Indian Ocean J. Mar. Sci. Vol. 9, No. 2, pp. 71 – 80.

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2012 Munga C. N., **Mohamed M. O. S.,** Obura D. O., Vanreusel A. and Dahdouh-Guebas F. 2012. Status of Coral Reef Fish Communities within the Mombasa Marine Protected Area, Kenya, more than a Decade after Establishment. Western Indian Ocean J. Mar. Sci. Vol. 10, No. 2, pp. 169-184

2013 Cowburn, B., Sluka, R., Smith, J., and **Mohamed M. O. S.** Tourism, Reef Condition and Visitor Satisfaction in Watamu Marine National Park, Kenya. Western Indian Ocean J. Mar. Sci. Vol. 12. No. 1, pp. 57-70,

2012 Tuda, A. and **Omar, M.,** 2012, January. Protection of marine areas in Kenya. In The George Wright Forum (Vol. 29, No. 1, pp. 43-50). George Wright Society.

2014 R. Amin, S. A. Andanje, B. Ogwoka, A. H. Ali, A. E. Bowkett, **M. Omar**, T. Wacher. The northern coastal forests of Kenya are nationally and globally important for the conservation of Aders' duiker Cephalophus adersi and other antelope species. Biodiversity and Conservation, DOI 10.1007/s10531-014-0842-z

2015 Pérez-Jorge S, Pereira T, Corne C, Wijtten Z, **Omar M**, Katello J. Kinyua M., Oro D., Louzao M. Can Static Habitat Protection Encompass Critical Areas for Highly Mobile Marine Top Predators? Insights from Coastal East Africa. PLoS ONE 10(7): e0133265. doi:10.1371/journal.pone.0133265

2016 **Mohamed, M. O. S.,** Mangion, P., Kairo, J. G., Dahdouh-Guebas, F., Koedam, N. Productivity of a peri-urban mangrove under sewage pollution. In S. Diop et al. (eds), Estuaries: A lifetime of Ecosystem Services in the Western Indian Ocean, Estuaries of the World. DOI 10.1007/978-319-25370-1_3.

2017 Jelvas Mwaura, Juliet Karisa, **Mohamed Omar Said**, Mike Olendo, Jillo Katello, Harrison Onganda, Judith Nyunja, Rose Ambae, Dishon Murage, Stephen Mussembi, David Obura, James Kamula, Noah Ngiasange, Stephen Katua: Kenya. edited by Obura D., Gudka M., Bijoux J., Freed S., Gian S.B., Maharavo J., Mwaura J., Porter S., Sola E., Wickel J., Yahya S. and Ahamada S. (2017) Coral reef status report for the Western Indian Ocean. Global Coral Reef Monitoring Network (GCRMN)/International Coral Reef Initiative (ICRI). pp 60 - 69.

Under Review Alati, V. M., Munga, C. N., Ochiewo, J., **Mohamed M. O. S.,** Dahdouh-Guebas, F., Koedam, N. The economic worth of Marine Protected Areas: The Case of Watamu Marine National Park and Reserve, Kenya

Thesis supervised:

2001 Alati, V. M. (2011) Estimating the value of Goods and Services in a Marine Protected Area: The Case of Watamu Marine National Park and Reserve, Kenya. Vrije Universiteit Brussel (VUB – 'Free University of Brussels'), Pleinlaan 2, B-1050 Brussels, Belgium and Universiteit Antwerpen (University of Antwerp), Groenenborgerlaan 171, B-2020 Antwerpen, Belgium

2014 Celine Frank (2014) Community participation in natural resources management successes and failures in Mida Creek mangrove forest, Kenya. Vrije Universiteit Brussels (VUB – 'Free University of Brussels'), Pleinlaan 2, B-1050 Brussels, Belgium

2016 Mark Kinywa (2014) The mangroves of Mida Creek: detecting structural changes over a decade. Vrije Universiteit Brussel (VUB – 'Free University of Brussels'), Pleinlaan 2, B-1050 Brussels, Belgium and Universiteit Antwerpen (University of Antwerp), Groenenborgerlaan 171, B-2020 Antwerpen, Belgium

2017 Ahmed Kuso (2017) Evaluation of impacts of community-based conservation on local community livelihoods I Lower Tana Delta. Pwani University

Doctorate

2015 – Ongoing Asma Awadh (ongoing) Evaluation of the status, distribution, threats and management of Dugongs (Dugong dugon) and their habitats in Kenya. Pwani University

Trainings

Aug 1 – 12, 2016 INternational inTEnsive southern training proGRAmme and network DEvelopment for marine and lacustrine scientists (InteGRADE), Zanzibar, organized by Universiteit Gent and Vrije Universiteit Brussel

30th Jul – 3rd Aug 2012: Regional Ecosystem Valuation Methodology Workshop – Indian Ocean Commission (IOC) in the Framework of the Western Indian Ocean Maritime Highway Development and Coastal and Marine Contamination Prevention Project, Dar es Salam, Tanzania

April 2011 – May 2012: Advanced International Training Programme in Integrated Sustainable Coastal Development – School of Global Studies, University of Gothenburg, Sweden

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CURRICULUM VITAE

PETER NJIIRI MWANGI

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Language:	Proficient in written and spoken English and Swahili languages

CAREER OBJECTIVE

Promotion of sustainable environmental management in the face of growing economic development through applied nature science. My aspiration is to serve in a challenging leadership position advocating for best environmental practices and ensure compliance with applicable international and national legal and policy instruments of good environmental governance and social responsibility.

KEY EXPERIENCE

Currently, deployed to the Wildlife Research and Training Institute(WRTI) as the head scientific Services to oversee implementation of external and internal projects including consultancy services in the field of Environmental and social impact assessments, development of protected area management plans and ecological assessments. In the process of transitioning from Kenya Wildlife Service (KWS) where ihave been the lead expert on Environmental Impact Assessment (EIA) and environmental Audits (EA). Have been responsible for coordination and implementation of environmental impact assessment and audit studies in National Parks and Reserves; Ecological monitoring of wildlife and also provide environmental and social impact technical advice for proposed development projects inside and neighbouring protected areas. Prepare terms pf reference for environmental assessment studies and provide advisory on cross cutting environmental issues for projects that are likely to impact on biodiversity in Kenya. I am competent in both social surveys and applied research in the natural resources management speciality and have undertaken various ecological monitoring projects with KWS in different park ecosystems. Due to the nature of my job I have developed research interests around environmental policy and ecological impact assessments but I am open to a wide range of research in environmental science, wildlife/behavioural ecology, conservation biology among others.

I am socially intelligent and possess strong administrative, training and analytical skills.

PROFESSIONAL MEMBERSHIP

Certified and registered Environmental Impact assessment and environmental audit Lead expertby the National Environment management authority

Member Environmental Institute of Kenya
Member Nature Kenya
Member East African Environmental Network

ACADEMIC QUALIFICATIONS

2004: Moi University, Eldoret, Kenya
Master of Philosophy degree in Wildlife Management

1998: Egerton University, Njoro, Kenya
Bachelor of Science degree (2nd Upper Honours), Natural Resources Management

1991: Chania High School, Thika, Kenya Certificate of secondary Education (KCSE).

OTHER PROFESSIONAL QUALIFICATIONS

2018: Advanced International Training Programme Certificate in **Strategic Environmental Assessment**. **NIRAS and Gothenburg University Sweden.**

2019 **Certificate of completion:** Biodiversity and ecosystem Services Focus: Oil and Gas **HSE International, LLC.** Sponsored by Kenya Petroleum Technical Assistance Project

2019 **Certificate in Quality management systems ISO 9001:2015. Implementation course. Kenya Bureau of Standards**

2017: **Certificate of completion:** Environmental and Social Impact Assessment: Focus on Oil and Gas sector **HSE International, LLC. Sponsored by Kenya Petroleum Technical Assistance Project**

2016: Certificate in Senior Management Course, **Kenya school of Government**

2016: Certificate in Performance management course, **University of Nairobi**

2010: Certificate in Environmental Impact Assessment (EIA) & Environmental Audit (EA) course, **University of Nairobi**

2013: Monitoring and Evaluation Training**: ZDU Global Implementation Solution**

2008: Certificate in Area focused training Course in Wildlife conservation and Management for African countries**, Japan Wildlife Research Centre:**

2011 Certificate in Environmental Management Systems **ISO 14001:2004 Lead Auditors Course, Kenya Bureau of Standards**

2009: Certificate in Quality Management System **ISO 9001:2008 Internal Quality auditing course, Kenya Bureau of Standards**

2011: Certificate in Integrated Waste Management: Design and Monitoring of containment Systems in Wildlife Conservation Areas, **University of Nairobi**

2011: Finance for non finance managers course, **Kenya Wildlife Service**

2010: Climate change and carbon trading sensitization training course **Kenya Wildlife Service:**

2010: Monitoring Important Bird Areas in Kenya,**Nature Kenya & National museums**

MAJOR ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) PROJECTS UNDERTAKEN

Lead Expert: Vipingo Ridge Wildlife Sanctuary project

Lead Expert: Proposed Kakamega Forest Conservation fence project. Prepared the ToRS, organised stakeholder consultation meetings, compiled the report and submitted to NEMA for approval

Lead expert: ESIA for establishment mountain Bongo sanctuary prepared the ToRs, organised stakeholder meetings, compiled the report and submitted to NEMA

Lead Expert: ESIA for Kitenden Corridor Tourism Infrastructure development project

Associate Scientist: Determination of Aircraft noise and its likely impact on Wildlife in Nairobi National Park. Part of the Consortium that compiled Technical reports for Kenya Airports Authority

L**ead Expert**: ESIA for proposed construction of 40 milk coolers in Uasin Gishu County

Lead Expert :EIA for development of sand dams for wildlife use in Tsavo Conservation Area

Lead Expert: Kenya Wildlife Service Wajir staff houses project compiled c the report and submitted to NEMA for approval

Lead expert: Ruiru Prison College sewer System construction EIA project report compiled the report and submitted to NEMA for approval

Lead Expert: Eburu forest Electric fence Environmental and Social Impact Assessment (ESIA) study report prepared the ToRS, organised stakeholder meetings, compiled the report and submitted to NEMA for approval(approved)

Lead Expert: Kenya Wildlife Service Nandi county Office block construction ESIA project report

Lead Expert: Environmental impact assessment for Nairobi west prison borehole project

Lead expert: Environmental and Social Impact Assessment Study Report for upgrading Tourist Roads in Aberdare National Park and Mt. Kenya National Park

PUBLICATIONS

Mwangi P.N, Milewiski A. and Wahungu G.M. (2004), Chemical composition of mineral licks used by elephants in Aberdares National Park. *Pachyderm Vol. 37: 59-67.*

Onkangi N. Ruth, **Mwangi Peter Njiiri,** Erick Maklago & Ondari Lilian 2018. Vulnerability and Adaptation Levels of the Construction Industry in Kenya to Climate Change. *Springer link*

Onkangi N. Ruth, Stephen Nyakondo **Mwangi Peter Njiiri,** Ondari Lilian, Ng'ang'a Wangui, Bore Wachira 2018 .Environmental management systems in construction projects in Kenya: barriers, drivers, adoption levels. *Rwanda Journal of Engineering, Science, Technology and Environment*

Mwangi P.N and Kaaria B.I 2012 ,Environmental Impact Assessment and audit as tools for Protected Area Management in Kenya. In "The Wildlife Researcher" a KWS e-publication issue.1 February 2012.

WORK EXPERIENCE

EMPLOYER AND PERIOD	POSITION HELD AND KEY TASKS
Wildlife Research &training Institute(WRTI) July 2021-to date	**Head Scientific services:** Appointed to oversee and coordinate the implementation of the scientific services department**.** Responsibilities include development of concept proposals to mobilise resources, Preparation of Terms of reference. Partners and stakeholder engagements. Multidisciplinary team composition and leading. Technical report writing and scientific publications
Africa Oil 2018 to date	**Biodiversity Advisor** for Africa oil and Tullow Kenya on impacts of oil drilling and production at South Lokichar basin in Turkana. Professional guidance on mitigation measures to avoid net loss on biodiversity and enhance project contribution to ecosystem services
Kenya Wildlife Service (KWS)	**Head- Environmental Impact Assessment (EIA)programme** **Duties**: a) Ensure KWS projects comply with Environmental Management and Coordination Act (EMCA) 1999 across the conservation areas b) Preparing terms of reference for EIA constancy services c) Compiling environmental sustainability reports for the organisation d) Training and environmental awareness creation across the organisation e) Formulation of policies and guidelines on environmental issues across the organisation f) Identifying projects requiring EIA and developing terms of reference g) Undertaking and Coordinating EIA and audit studies for projects in wildlife protected areas

	h) Evaluating EIA studies conducted by Lead Experts outside KWS. i) Liaising with other relevant agencies on EIA and audit issues j) Ensuring implementation of EIA mitigation recommendations as well as Monitoring & Evaluation of projects for compliance. k) Preparing timely and accurate EIA & environmental audit reports
KWS 2009- 2011	**Senior Research scientist** in Northern conservation Area (NCA) a) Articulating and implementing biodiversity policies and strategies b) Undertaking wildlife ecological assessments c) Establishing, updating and maintaining database d) Identifying threats to biodiversity and recommend appropriate intervention initiatives e) Coordinating a multi-disciplinary team to carry out biodiversity research programs f) Ensuring cost effective utilization of resources g) Disseminating research findings to all interested parties through the appropriate media as per laid down procedures h) Preparing work plans and budgets i) Liaising with GOK and other stakeholders in conservation programs j) Coordinating EIAs and ensure the implementation of EIA recommendations k) Supervising, appraising and mentoring staff working under me
KWS 2007-2008	**Research scientist** Meru National Park. Responsible for ecological monitoring activities within the conservation area. Specific tasks included species surveillance including aerial and ground animal counts, habitat management, environmental audits and evaluation. Collecting and analysing human wildlife conflict data. Technical reporting and writing.
KWS 2006- 2007	**MIKE (Monitoring Illegal Killing of Elephants) database officer** The tasks included data entry, verification of elephant mortality field reports, data analysis and preparing monthly and annual reports. Preparation of elephant mortality status report for submission to Convention on International Trade on Endangered Species (CITES)
Eco-conquest Africa 2005 – 2006	**Environmental consultant,** Duties: Conducting and Compiling environmental impact assessment project reports
KWS 2004- 2005	**Intern Kenya Wildlife Service** **Duties:** Conducting animal censuses, ecological monitoring field data collection and report writing in various research activities in parks and reserves

2001-2003 Aberdare's Environment and Nature conservation project	**Project coordinator,** Community based conservation and HIV/AIDS awareness project. Duties and responsibilities included fundraising, financial and technical reporting and coordination of project activities, and organizing meetings and liaison with project financiers.

SEMINARS AND CONFERENCES

In the course of my duties as an environmentalist I have actively participated in a number of workshops and seminars as a resource person. Presented ESIA reports to stakeholders and also involved in policy document formulations

Some of the policy documents that I have given input on includes:

- National and County Environmental Action Plans Kenya
- National state of the environment report
- Amboseli Ecosystem management Plan Strategic Environmental Assessment
- Wildlife Service 2008-2012 strategic plan
- Meru conservation Area management plan
- Mara basin Strategic Environmental assessment

LEADER SHIP

Member of the Advisory board Gospel Evangelistic churches of Kenya(G.E.C.K)

EXTRA-CURRICULAR ACTIVITIES

- Bird watching
- Travelling and nature walks
- Member of church men's choir
- Indoor games
- Reading

REFEREES

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Appendix B Marine Survey Report Findings

Appendix B.1
2Africa Cable Specialist Marine Assessment

SPECIALIST MARINE ASSESSMENT FOR THE 2-AFRICA SUBMARINE CABLE ROUTE -KENYA

by

Wildlife Research and Training Institute in partnership with Kenya Wildlife Service
P.O Box 842-20117
Naivasha, Kenya

SUBMITTED TO

AECOM AFRICA (PTY) Ltd

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Nairobi, Kenya.

November 2021
Revised February 2022

Declaration

The Specialist Marine habitat impact assessment for the proposed 2 Africa submarine cable is submitted by Wildlife Research and Training Institute. To our knowledge, all the information contained in this report is a true reflection of the Mombasa Marine National Reserve environmental setting.

ON BEHALF OF WRTI /KWS

Name : Peter Njiiri Mwangi Date: 19th November 2021

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ACRONYMS

ASN	Alcatel Submarine Networks
BAP	Biodiversity Action plan
BMH	Beach Man Hole
CIEEM	Chartered Institute of Ecology and Environmental Management
EACC	East African Coastal Current
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
ESIA	Environmental and Social Impact Assessment
IEMA	Institute of Environmental Management and Assessment
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
KM	Kilometre
KMFRI	Kenya Marine and Fisheries Research Institute
KPA	Kenya Ports Authority
KWS	Kenya Wildlife Service.
M	Metres
MARPOL	International Convention for Prevention of Marine Pollution for Ships
MMNP	Mombasa Marine National Park
MNPR	Mombasa National Park and Reserve
MPA	Marine Protected Area
NEM	North East Monsoon
MNR	Marine National Reserve
MNP	Marine National Park
PA	Protected Area
SEC	South Equatorial Current
SEM	South East Monsoon
TW	Territorial Waters
UK	United Kingdom
WRTI	Wildlife Research and Training institute

1.0 INTRODUCTION

This report documents a specialist marine ecological impact assessment that will feed into the Environmental Impact Assessment (EIA) study for the Kenya element of the 2Africa submarine cable project in accordance with the Environmental Management and coordination act EMCA cap 387 of the laws of Kenya. The report also supports applicable permitting procedures for the submarine cable Right of way through a marine protected area as required by Kenya Wildlife Service.

Through KWS, Wildlife Research and Training institute (WRTI) was subcontracted by AECOM Africa (Pty) Ltd. for a marine specialist Ecological Impact Assessment. The assessment aimed at documenting the marine biodiversity at the Mombasa Marine Park and Reserve which is one of the key biodiversity areas that the cable traverses.

1.1 Project Overview: 2 Africa Submarine Cable installation

The goal of 2Africa submarine cable project is to significantly enhance connectivity across Africa and the Middle East. 2Africa will be one of the largest subsea cable projects in the world covering a distance of 37,000KM and will interconnect Europe, the Middle East, and 21 landings[1] in 16 countries in Africa, as outlined in Figure 1.

Figure 1,2Africa main cable route and country branching units

Figure 1: 2-Africa submarine cable route around Africa connecting to Europe

The system is expected to go live in 2023/2024, delivering more than the total combined capacity of all subsea cables serving Africa today, with a design capacity of up to 180 terabits per second (Tbps) on key parts of the system. 2Africa will deliver much needed internet capacity and reliability across large parts of Africa, supplement the fast-growing capacity demand in the Middle East and underpin the further growth

of 4G, 5G and fixed broadband access for hundreds of millions of people. The engineering, manufacturing and installation of the cable has been contracted to Alcatel Submarine Networks ("ASN"). ASN appointed AECOM to support various aspects of project planning and implementation in selected landing countries.

AECOM has commissioned studies to provide baseline information and the following information has been provided:

- Information on marine geophysical and geotechnical specialist work that has already been conducted by Fugro in their geotechnical surveys for each branch cable and landing. This will help inform the type of marine specialist impact assessment that needs to be undertaken. For the list of full survey findings, please refer to the charts outlined in Appendix A.
- A summary of the sampling data collected, and a high-level overview of the findings.
- A high-level description of the proposed project infrastructure and installation activities.
- Environmental and social impact assessment study.

1.2 Project Scope in Kenya

The 2Africa Project in Kenya will entail the installation and operation of submarine cables through the territorial waters (TW) and Exclusive Economic Zone (EEZ) of Kenya, as well as two landing locations (site where the submarine cable system exits the ocean and reaches/ connects to a terrestrial telecommunication infrastructure at the beach Manhole) both located in Mombasa (Figure 2):

- 'Mombasa North' on Shanzu Beach, near PrideInn Paradise Hotel,
- 'Mombasa South' on Nyali Beach near the Sun Africa Beach Hotel.

The proposed installation of branch cables will traverse a Marine Protected Area (MPA), namely the Mombasa Marine National Reserve and The Mombasa Marine National Park, with the south branch crossing the Marine National Reserve, and the north branch crossing the Marine National Park and Reserve (Figure 3).

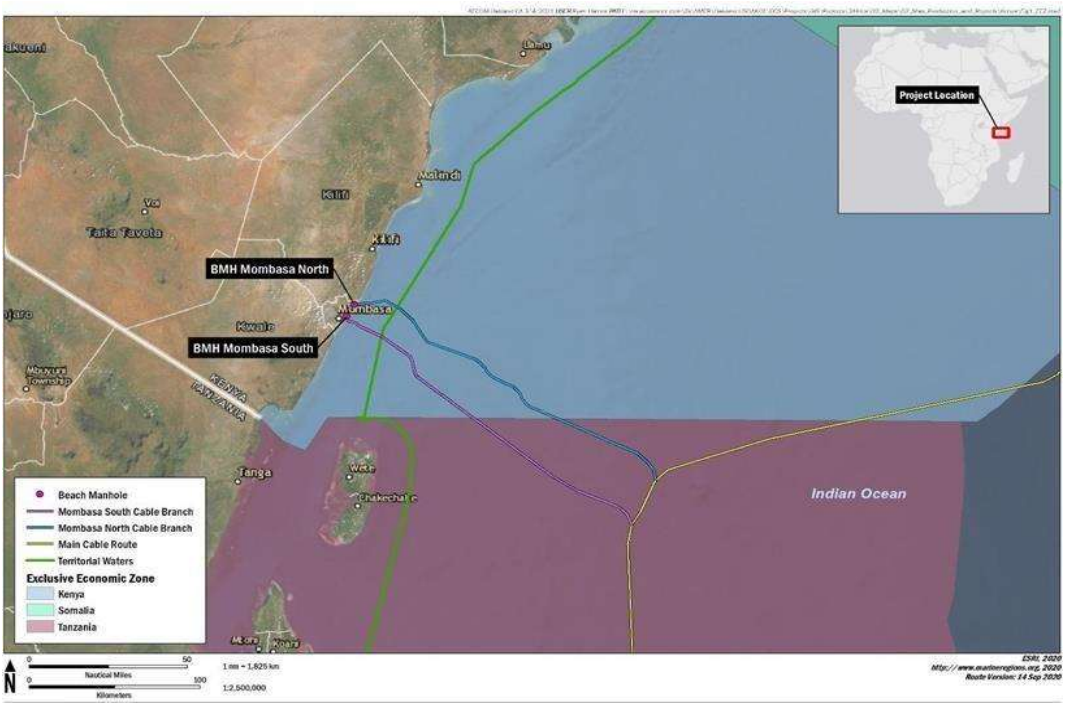

Figure 2. 2-Africa cable alignment route in Kenya EEZ

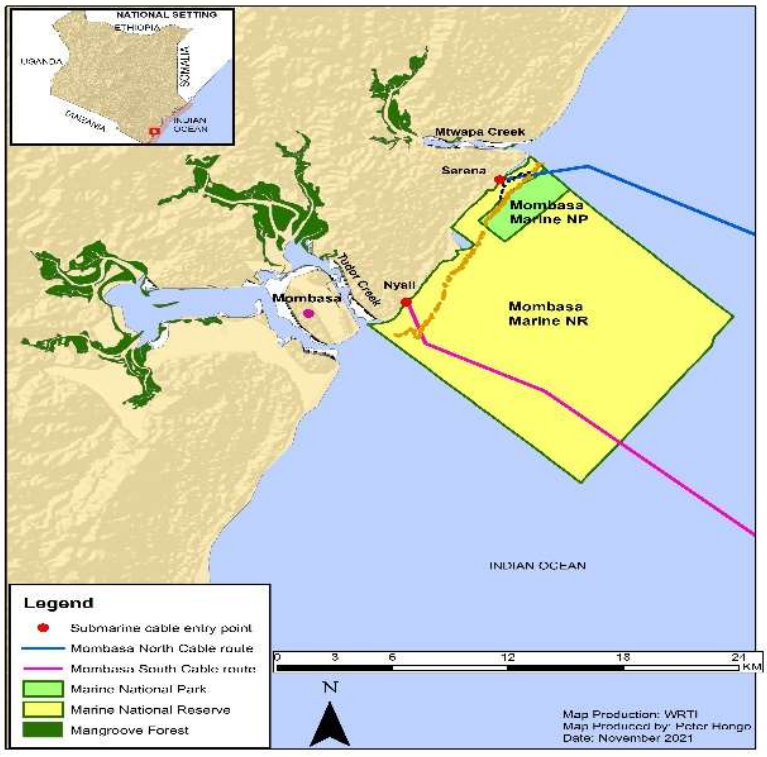

Figure 3. Map of the project site showing cable route relative to the Marine protected areas

1.3 Rationale

This specialist marine ecological assessment of the cable route and installation activities is required to determine the potential impacts of the project on marine biodiversity. MPAs are critical habitats and the location of the project within this area require good understanding of the baseline biodiversity and analysis of potential impacts to avoid net loss and where possible enhance biological diversity.

Recognizing the need to understand the ecological sensitivity of the marine protected area AECOM subcontracted WRTI through Kenya Wildlife Service to undertake a marine ecological assessment and identify the potential impact of the cable project to the marine life.

1.4 Objectives

The overall goal of this assessment was to determine whether the potential impacts of the project interaction with the sensitive marine ecosystem are significant and ensure that adequate mitigation measures are in place so that the project does not constitute a net loss in biodiversity upon implementation. The report is also a prerequisite of the granting of right of way for the cable way leave through the MPA by KWS. The specific objectives are:-

i. Document the marine biodiversity of the area
ii. Identify potential impacts of the project and suggest mitigation measures
iii. Prepare a report to feed into the main ESIA KWS to facilitate granting of right of way

1.5 Study area

The proposed submarine cable laying route will transit through Mombasa Marine National Park and Reserve which is located within the Nyali-Bamburi-Shanzu area, between Mtwapa creek and Tudor creek, north of Mombasa City/Island (Figure.4). The Mombasa Marine National Park (MNP) was gazetted in 1994 purposely as a tool to promote biodiversity conservation, to attract tourists and as such enhance foreign revenue and to enhance fisheries management as well as to promote scientific research and education & awareness programs. Kenya wildlife services (KWS) are mandated to manage both marine parks and reserve areas in accordance with a management plan that complies with the requirements prescribed by the fifth schedule of the Wildlife Conservation and Management Act (2013).

The Mombasa National Park and Reserve (MNPR) is delineated in zonation scheme that entail two management regimes within their border: a park and reserve. The Park is fully protected (no-take zones) and covers a small area (in green, Figure 4) whereas the reserve is partially protected (allows small-scale fishing) and extends from the reefs adjacent to Tudor creek (English point) (in yellow, Figure.4). The MPA is adjacent to a tourist hotspot area, with high a number of hotels and resorts as it offers recreational ventures such as snorkeling and SCUBA diving within the fringing reefs

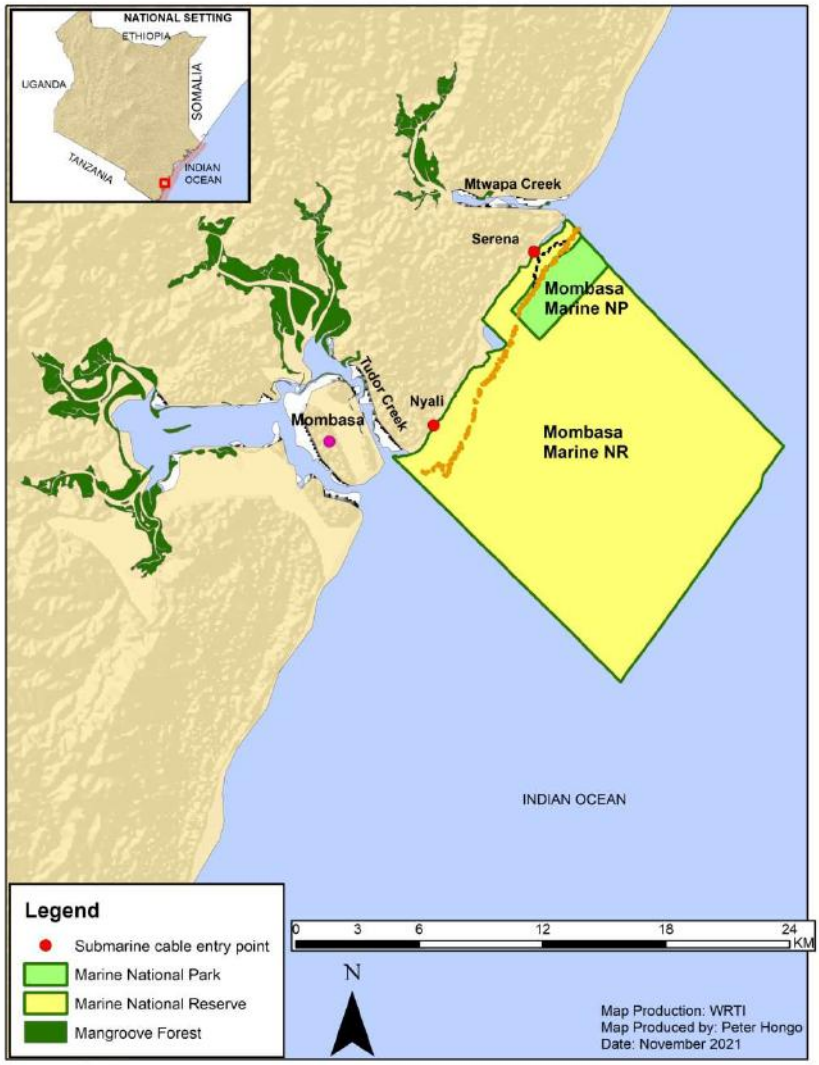

Figure 4 Mombasa Marine National Park & Reserve

1.6 Study scope

This specialist marine assessment is building on the bathymetry survey which has provided information on seafloor conditions, geological and geotechnical setting of the project. The assessment provides the marine biodiversity status and ecosystem services interdependence of the project within the MPA and the immediate onshore habitats neighbouring the cable landing sites. It documents the status of biodiversity within the Mombasa Marine Park and reserve. It further relates the possible interaction of the 2-Africa cable installation with the ecologically sensitive areas of the MPA and the shoreline ecosystem and employs expert judgement to identify and analyze potential impacts.

2.0 METHODOLOGY

This section describes the methodology which will be used to collate data and information on the marine habitat and associated biodiversity and evaluate potential environmental associated with the installation and operation of the Project. It outlines the key stages of the assessment process and the approach taken to identify and evaluate the potential impacts and effects associated with the Project.

The assessment methodologies take into account the requirements of the Kenyan Environmental Management and Coordination (EMCA) Act, 2015, as well as relevant best international practice, including:

- IFC Performance Standards.
- The UK Institute of Environmental Management and Assessment (IEMA): Suite of General and Topic Specific Guidelines for Environmental Impact Assessment (various dates).
- The UK Chartered Institute of Ecology and Environmental Management (CIEEM): Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal (2010).

The Project aims to integrate environmental considerations into the route design and optimization process, which includes desktop studies and a marine survey. The route design and optimization process aims to avoid or reduce disturbance of known sensitive environmental and social receptors, where-ever possible.

2.1 Desktop research on biodiversity status

Data and information from recent rapid surveys of the intertidal and sub tidal areas was gathered through detailed desktop research of the status of coral reef colonies and sea grasses in the project area of influence. Search and review of existing marine life inventory of the area done in the last 5 years.

2. 2 Focused group discussions

A focused group discussion with scientists who have undertaken recent studies in the area and focused discussion of the ecological interaction of cable laying activities within some of the critical habitats. This will provide current information on the status of these ecologically sensitive habitats.

Experts from relevant stakeholders were consulted to provide a comparative analysis on the marine biodiversity and the habitats, within the Project area of influence.

2.3 Marine habitat Site surveys

Walking transects along the cable landing site on the beach at Nyali and Shanzu was carried out and biodiversity data and relevant information was recorded and mapped.

Data obtained from routine boat transects undertaken by KWS/ WRTI was used to assess the status of fish species within the marine protected areas and the immediate environment.

2.4 Impact identification and evaluation

The assessment was aimed at identifying potentially significant adverse environmental effects in respect to biodiversity and ecosystem services that cannot be avoided. Appropriate project specific mitigation measures to reduce or offset adverse environmental effects or maximize environmental benefits have been proposed.

Preliminary reviews of the potential interactions between project activities and ecological sensitivities have been documented in this report but the social impacts are documented in the main ESIA Report.

2.4.1 Impact rating

Potential impacts identified were rated in terms of a range of impact using the following criteria:

Positive or negative impact:

- Positive impacts: Impacts those are beneficial to the environmental
- Negative impacts: Impacts those are detrimental to the environmental Direct or indirect impact:
- Direct impacts: Impacts caused by a Project action and which occur at the same time and location as the activity.
- Indirect impacts: Impacts caused by a Project action, but which occur later in time or are farther removed in distance but can be reasonably foreseen. Indirect impacts may include impacts related to induced changes in the pattern of use of the marine area, or related effects on air and water and other natural systems, including ecosystems.

Impact duration:

- Short-term (temporary): (impacts of less than one-year duration).
- Medium-term: (impacts between 1 to 10 years duration).
- Long-term (permanent): (impacts of more than 10 years duration).

Impact reversibility:

- Reversible: when there is a possibility that the affected environmental factor will return to conditions similar to those it had before the impact occurred.

- Irreversible: when the possibility of the affected environmental factor returning to conditions similar to those it presented before the impact of the impact does not exist or is negligible.

Impact scale

- Local: when the effects on the environmental factor in question are restricted to a local extent; for the socioeconomic environment, spatial coverage is local when the impact is restricted to a municipality.
- Regional: when the effects on the environmental factor in question reaches a regional extent; for the socioeconomic environment, spatial coverage is regional when the impact affects more than one municipality.
- National / international: when the effects on the environmental factor in question have a national, continental or global character; for the socioeconomic environment, coverage is supra regional when the impact affects more than one municipality and is national, continental or global.

Cumulative impacts:

- Cumulative impacts: The additive impacts resulting from the impacts associated with the Project, when considered in combination with any other development activity proposed within the anticipated area of impact, at the same time.

2.4.2 Impact Magnitude

The magnitude of a predicted impact is defined as the extent of change which may be expected and is likely to be as a result of a range of factors including:

- the anticipated geographic area that may be affected;
- the duration and frequency of an impact; and
- the degree of environmental or socio-economic change and/or level of community concern.

Table **1** below sets out indicative guidance for the consideration of potential impact magnitude.

Table 1: Impact Magnitude – Indicative Criteria

Definition	**Indicative description of impact***
No effect	No measurable change from background levels (ecosystem, population, natural resources). Imperceptible or negligible. Social, economic or cultural impact is 'imperceptible' or unlikely to be noticed.

Slight	Small change but none-the-less measurable relative to background levels. Highly localized to immediate vicinity of (e.g. within an order of 500m). Short term. Not expected to contribute to cumulative effects.
Minor	Measurable change relative to background levels. Changes might be noticeable but fall within the range of normal variation. Impacts felt at local level and/or a group of individuals of a population at a localized area and/or over a short period (one generation or less). Short term. Impact is not expected to contribute to cumulative effects. Changes in social, economic or cultural dynamics with minor and temporary effect on any given sector performance and/or population wellbeing. Limited impact to archaeological, cultural or natural resources. Unlikely to result in concerns being raised by governmental bodies or stakeholders. Can be positive or negative. Mitigation measures for negative impacts, if required, can be readily implemented.
Medium	Large change relative to background levels (ecosystem, population, natural resources), and likely to contribute to cumulative effect. Changes exceed the range of natural variation. Impacts may be felt at regional level and/or affect a portion of the population or species over one or more generations but does not change the integrity of the population as a whole. Impacts may be medium to long term. Changes in social, economic or cultural dynamics with moderate and noticeable adverse effect on any given sector performance and/or population wellbeing.; Involved damage to archaeological, cultural or natural resources of local importance. Such impact may result in concerns being raised by governmental bodies or stakeholders. Can be positive or negative. Negative impact can be minimized or avoided by application of specific mitigation measures. After mitigation, residual impacts may require monitoring.
High	Substantial change to the baseline and long term (>5 years) changes in an ecosystem. Changes are well outside the range of natural variation and assisted rehabilitation might be required. May affect the whole population or species causing a change in abundance and/or distribution, or the size of genetic pool such that natural recruitment would not return to that population, or any population of species dependent upon it. Impacts may be widespread. Impact may be a major contributor to cumulative effects. Changes in social, economic or cultural dynamics with major adverse effect on any given sector performance and/or population wellbeing. Involves damage or permanent loss to archaeological, cultural or natural resources of international/national importance. Such impacts may result in immediate intervention by governmental bodies and stakeholders. Can be positive or negative. Negative impact may be difficult to mitigate and/or irreversible.

***Note these descriptions are for guidance only. Professional judgement may be applied in specific circumstances out with these guide descriptions.**

2.4.3 Receptor Value/Sensitivity

Receptor sensitivity criteria (**Table 2-2**) have been applied taking account of key factors including:

- Relevant legislative or policy standards or guidelines;
- The relative value or importance of the receptor at local, national, or international level. Importance of a receptor may relate to biodiversity, ecosystem services, cultural or economic significance; and
- The vulnerability of a receptor, its capacity to absorb change; and its ability to recover from an impact.

Table 2: Receptor Value/Sensitivity - indicative criteria

Definition	Indicative description*
Not sensitive	Resilient to project activities. The receptor is resistant to change or is of little environmental or social value.
Low	Receptors with limited value or importance attached to them, even at local level. Easily adaptable to change, or likely to recover immediately (within days/weeks).
Medium	Receptors of importance at a local/island level. The receptor has moderate capacity to absorb change without significantly altering its present character. And/or recovery likely within 1-2 years of cessation of activities or highly localized medium-term recovery (2-5 years).
High	Receptors of importance at island level. The receptor has low capacity to absorb change without fundamentally altering its present character, is of high environmental or social value. Species of potential conservation significance. and/or recovery likely 5-10 years following cessation of activity, or that cannot easily be recovered.
Very high	Receptors of importance at an international level. The receptor has little or no capacity to absorb change without fundamentally altering its present character, is of very high environmental or social value. Species of potential conservation significance and/or Recovery likely only over an extended period (over 10 years) following cessation of activity and/or a permanent deleterious effect.
*Note these descriptions are for guidance only. Professional judgement may be applied in specific circumstances out with these guide descriptions.	

2.4.5 Impact Significance

Magnitude of impact and sensitivity of receptor is then combined to determine the predicted significance of any impacts, as shown in Table 1-3 below.

Table 3: Impact Significance Matrix

		Sensitivity			
		Not sensitive	Low	Medium	High
Magnitude	Negligible	Negligible	Minor	Minor	Minor
	Minor	Minor	Minor	Moderate	Moderate
	Medium	Minor	Moderate	Moderate	Major
	High	Moderate	Moderate	Major	Major

3.0 PROJECT DESCRIPTION

The project proponent intends to install a submarine cable in the Indian Ocean waters. Within the Kenyan territorial waters, from the Kenyan economic exclusive zone (EEZ) the cable will branch into two landing sites. The Southern cable will be routed to Nyali beach and the Northern cable routed to Shanzu near Serena beach. The two submarine cables will traverse through the Mombasa MPA stretching 18km in length. The marine protected area is within the mandate of KWS for the conservation of wildlife marine biodiversity. The proposed cable installation will enter through the south branch crossing the Marine National Reserve, and the north branch crossing both the Marine National Park and the Reserve (Figure 5).

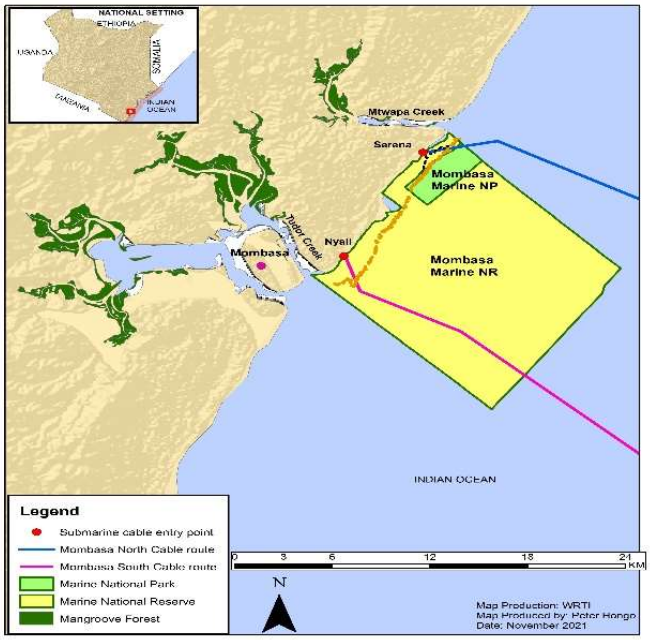

Figure 5. Cable alignment showing the North and South landing points and the MPA

The ecological sensitivity of each segment of the submarine cable across the continental shelf for the southern and northern route landings in the Kenya is described in section 3.1 and 3.2 below.

3.1 Southern route submarine cable branch

The length of the cable through the MPA in this section is 15.4 km. The important habitat traversed is designated as a Marine reserve that falls under category II of the IUCN Protected Area (PA) classification. The Reserve is set aside to protect ecological processes, along with the complement of species and ecosystems characteristic of the area and allows for environmentally and culturally compatible public use. Some of the activities taking place in the reserve include fishing, glass-bottom boating, snorkeling and swimming.

Table 4 below outlines the cable installation activity relative to site environmental setting.

Table 4. Southern cable segment environmental setting

Section of the Cable	Substrate Characteristics	Environmental Setting	Project Installation Methods
From the BMH to the HWM	This is the terrestrial component and will consist of a stretch of sandy beach of approximately 121 m, from the intertidal zone to the BMH to the HWM.	The cable route does not fall directly within sensitive environments, but sensitive sites were identified in the Project area of influence. The cable-landing site is not very far from turtle nesting sites along Nyali Beach.	The cable will be buried to a depth of 2 m beneath the sand.
From HWM to 1.3 km offshore (15 m deep) (in the Mombasa MNR)	Soft-bottom, sandy substrate that transitions to hard bottom	Sea grass and corals are present.	The cable will be diver-laid and buried in this section where feasible, and routed around corals and boulders. Articulated pipe will be applied for 248 m of the route, adding additional weight that will further prevent cable movement once installed.
From 1.3 km (15 m deep) to 10.6 km (292 m deep) (in the Mombasa MNR)	The seafloor drops off to deeper waters and is characterised by steep slopes, boulders, debris, rocks and depressions.	Some corals and seagrass are present before entering the deep-sea habitat.	The cable will be laid on the surface, meaning that no plough burial plough will be undertaken in this section.
From 10.6 km (292 m deep) to 234.6 km (1,000 m deep) (outside the Mombasa MNR)	In this section, the seafloor substrate is comprised of softer, thicker sediments, with occasional boulders, debris, rocks and depressions encountered along the route.	This section transits into deep sea, where the seafloor flattens out and the marine habitat changes, becoming less sensitive ecologically.	Plough burial is planned for this section of the route, with two small breaks in ploughing of 600 m and 6 km.

Notes:

BMH = beach manhole
HWM = high-water mark
km = kilometre
m = metre
MNR = Marine National Reserve

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The Southern cable Beach Manhole is situated at Nyali public beach the Nyali golf club is not far from the landing site. Except for the sandy beach the onshore landscape is significantly modified by human activities. See the Google image (figure 6).

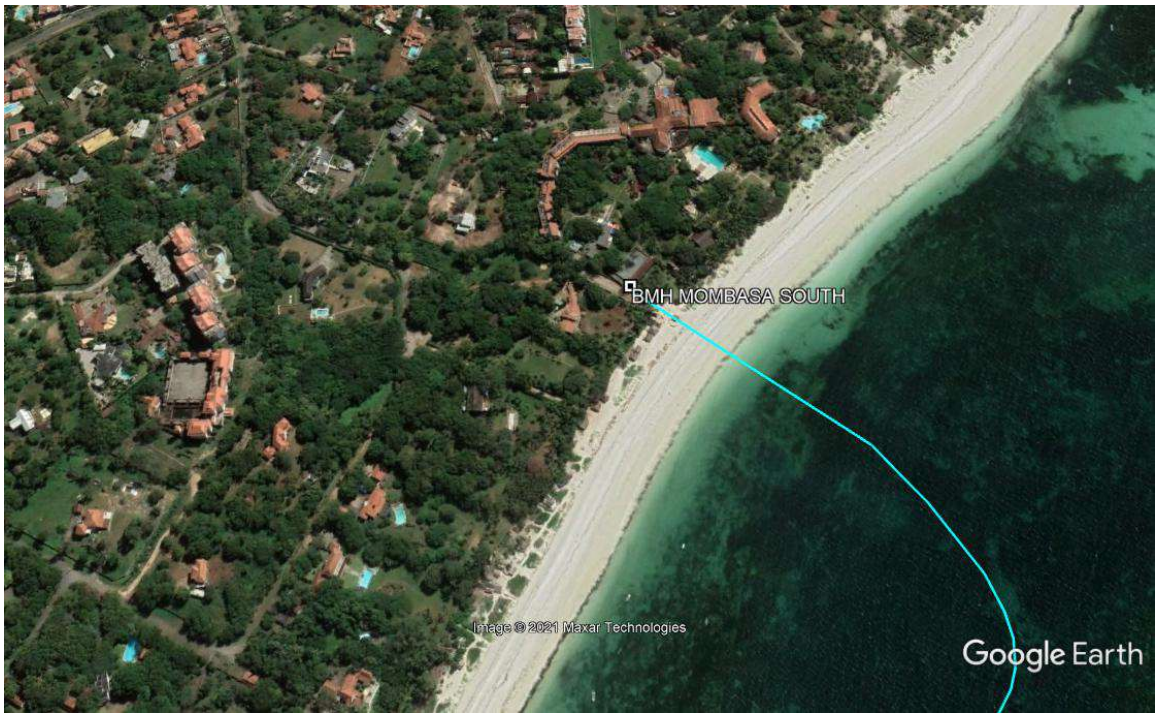

Figure 6 Southern cable BMH site (source Google Earth, ASN)

3.2 Northern route sub-marine cable branch

The length of the cable through the MPA in this section is 2.5 km where 2km traverse the national reserve and only 0.5km of the cable traverse the marine Park. The Park falls within category I of the IUCN protected area classification where the area is set aside to protect biodiversity and also possibly geological/geomorphologic features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Table 5 outlines the cable installation activity relative to site environmental setting.

Table 5. Northern cable segment environmental setting

Section of the Cable	Substrate Characteristics	Environmental Setting	Project Installation Methods
From the BMH to the HWM	This is the terrestrial component. It will consist of a stretch of sandy beach from the intertidal zone to the BMH to the HWM.	The cable route does not fall directly within ecologically sensitive areas but is instead situated on a sandy stretch of beach. However, there is the potential for turtle nesting nearby because the cable-landing site is not far from known and recorded turtle nesting sites. Tourism activities are prevalent along the beach, with a number of hotels and boat operators present. Notable beach erosion was recorded as well.	The cable will be buried to a depth of 2 m beneath the sand.
From HWM to 2.4 km offshore (24 m deep) (in the Mombasa MNP and the Mombasa MNR)	Soft-bottom, sandy substrate that transitions to hard bottom	Sea grass and coral habitats present. The cable route in the Mombasa MNR is approximately 2 km long, and the route in the Park is approximately 500 m long.	The cable will be diver-laid and buried in this section, where feasible, and routed around corals and boulders. Articulated pipe will be applied for 248 m of the route, adding additional weight that will further prevent cable movement once installed.
From 2.4 km offshore (24 m deep) to 4.7 km (169 m deep) (outside of the Mombasa MNP and the Mombasa MNR)	The seafloor drops off to deeper waters and is characterised by steep slopes, boulders, debris, rocks and depressions.	A few small coral outcrops are present. This segment is outside the MPA and is of low ecological sensitivity.	This segment of the cable will be laid on the surface, meaning that no plough burial or trenching will be undertaken in this section. The cable will be routed around coral and boulders.
From 4.7 km (169 m deep) to 87.058 km (1,000 m deep) (outside the Mombasa MNP and the Mombasa MNR).	The seafloor flattens out with softer, thicker sediments, with occasional boulders, debris, rocks and depressions along the route. Plough burial is planned for this section of the route.	Deep sea environment outside the Mombasa MPA. This area is not ecologically sensitive and has neither coral gardens nor sea grasses.	Plough burial is planned for this section of the route, with brief breaks in ploughing, typically around cable crossings.

Notes:

BMH = beach manhole
HWM = high-water mark
km = kilometre
m = metre
MNP = Marine National Park
MNR = Marine National Reserve
MPA = Marine Protected Area

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The Beach Manhole cable landing is located at a relatively busy area where the public access the beach for various activities. A number of tourist beach hotels engulf the onshore making it a modified habitat with high end tourist hotels. See the Google image (Figure7).

Figure 7. Northern cable BMH site (source Google Earth, ASN)

4.0 BASELINE INFORMATION

4.1 Mombasa Marine Protected Area (MPA)

Mombasa Marine National Park and Reserve were established in 1986 and formalized in 1991, covering 10 km^2 and 200 km^2 respectively. The marine park is localized within the marine reserve (figure 8). The park and reserve protect the Nyali-Bamburi-Shanzu shallow lagoon system, which is well-flushed over tidal cycles by overtopping of waves on the fringing reef and strong tidal forcing. The lagoon is bordered by Mtwapa and Tudor creeks to its north and south respectively. These two creeks are reported to feed nutrients into the lagoon system over the wet season and pollutants in the form of raw urban sewage. The MPA straddles next to the urbanized, tourist primed and densely populated city of Mombasa. SCUBA diving, snorkeling and glass-bottom boat tours are common attractions with hotels lined across the MPA beaches.

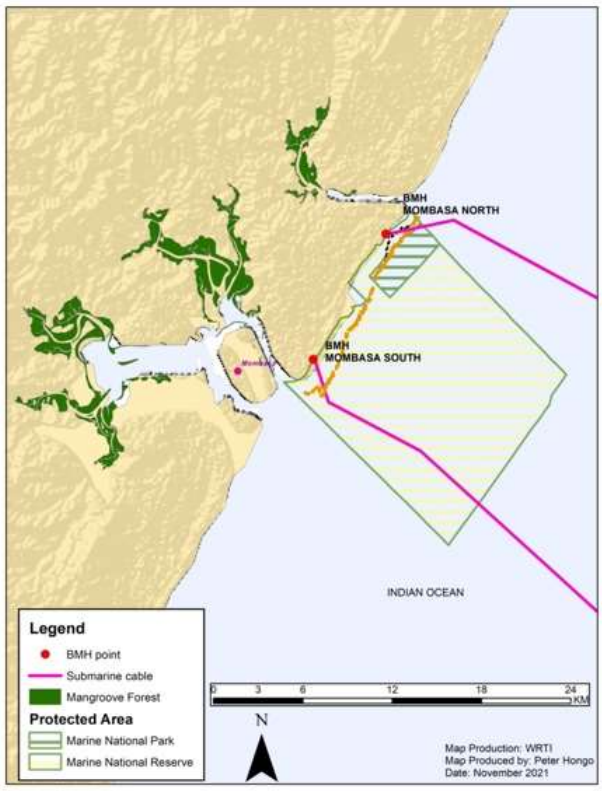


Figure 8 . Map of Mombasa showing the Mombasa Marine National Park and Reserve

Offshore marine habitats include primarily soft-substrate sandy slopes from 25 m depth down the continental slope. From the channel entrance at 25 m depth the bottom is primarily a rocky platform along the shipping channel to a point off the tip of Mombasa Island and English Point. From this point at the mouth of Tudor Creek and inwards, the creek bottom is soft silty sand and mud. Small mangrove stands line the Nyali shore near the mouth of the creek, and the extensive inner reaches of Tudor Creek are dominated by mangrove forests. North and south of the Mombasa harbor entrance, located within Tudor Creek, fringing coral reefs line the

coastline with main coral growth on the outer slopes at 8-15 m and in lagoon patch reefs. Lagoons are dominated by seagrass beds about 1-6 m deep. The intertidal zone in the project area is made up of rocky limestone cliff and platforms, with sandy beaches in sheltered locations within Tudor Creek and on the fringing reef coastlines.

Shallow marine ecosystems in the study area are moderately to seriously degraded. Mombasa town has been in existence for several centuries, and long term resource extraction for food and pollution from multiple sources have degraded the marine communities within Tudor Creek and along the main channel (shipping channel) out beyond the reefs. Reefs and seagrass beds of the Mombasa Marine Park and Reserve are in moderate condition and under protective legislation under the Wildlife Conservation and Management Act and enforced by the Kenya Wildlife Service. The reefs in the Mombasa Marine Reserve are utilized for fishing.

4.2 Physiographic conditions

4.2.1 Geology

Geologically, the Kenya coast is similar to the regional geological setting, with crystalline rocks of Archean age within the hinterland to unconsolidated recent sediments at the coast. The coastal plain has essentially been "sculptured" by Quaternary (1million years to present) sea level changes. Of particular importance to the coastal plain and continental shelf was the Last Glacial Maximum low sea level stand (approximately 130 m below present), approximately 18,000 years ago.

Late Pleistocene Sea level changes have resulted in several "Beach rock" and Aeolianite (lithified dune sequences) calcarenite sequences being deposited along the coastline. Limited deposits are found onshore, with the vast majority being located offshore. These deposits are normally formed as narrow bands of outcrop that follow paleo-coastlines, the result of sea level still stands. They also provide the base for coral reef formation. Beach rock and Aeolianite sequences are regarded as near-ubiquitous features along the sub-tropical and tropical coast of East Africa. Mesozoic to recent sediments underlay the coastal areas.

Kenya's continental shelf is narrow. The edge lies at comparatively shallow depths, between 60m and 100m. In places there appears to be a very narrow shelf, possibly indicating faulting activity. Generally, sand appears to be the major constituent but grades with depth into muds. Kenya's coastline is relatively stable tectonically, and no major earthquake sources are found nearby. The closest major volcanoes are on land in the Great Rift Valley and in the Comoros. Deepwater turbidity currents are a potential hazard wherever loose sediment is deposited on steep slopes, particularly if earthquakes occur. The Kenya coast was impacted to a minor extent by the tsunami of December 26th, 2004, experienced as tidal surges of 0.5-1 m. No closer major tsunami sources are known.

The project area of influence is geologically stable and the sub tidal benthic habitat dominated by sandy/muddy environments at depths > 30 m with rocky reef areas shallower than 25m.

4.2.2 Climate

The climate of the Kenya coast is dominated by the southeast and northeast monsoons (SEM and NEM, respectively). The SEM occurs from late April to October and is characterized by rougher, strong winds from the southeast bringing high wave energy and rainstorms towards Mombasa and the channel entrance. The NEM occurs from December to late March and is characterized by calmer, drier winds from the northeast and more favorable conditions for shipping and other marine related activities. Between the two seasons there are calm doldrums conditions lasting approximately 4 weeks, but precise timing varies from year to year. Heaviest rainfall and worst conditions for marine work are in late April to August.

Mombasa is characterized by a warm tropical marine environment, dominated by the northward flowing East African Coastal Current and reversing winds of the monsoon. This results in a strong seasonal signal being generally warmer and calmer in the Northeast Monsoon (NEM) from December to April, and cooler and rougher in the Southeast Monsoon (SEM) from May to October. Most marine/maritime activities are more feasible and safer during the calmer months of the northeast monsoon.

4.2.3 Tides

Tides on the East African coast are semidiurnal with a mean amplitude of 4 m, spring tide amplitude of > 4 m and neap tide amplitude of approximately 2 m. As a result, currents in reef channels and creeks are very fast and complete a full cycle in approximately 12.5 hours. This may affect project operations in two ways: -

1) Difficulty in maneuvering vessels during cable-laying operations.
2) Transport of suspended sediments and any other water-borne substances, which may be critical during stages of dredging and operations when sensitive habitats are downstream of operations. This may necessitate operations only during tides phases when water flow is towards the open sea.

The Kenya Marine and Fisheries Research Institute maintains a tide gauge in Mombasa Harbor as part of the global sea level monitoring network. Annual tide tables are published by the Kenya Ports Authority, and are freely available on the internet. The Sea level rise for the Western Indian Ocean, as a component of global climate changes are projected to be in the global range of 20-50 cm per 100 years.

4.2.4 Currents

Currents in the area are dominated by separate offshore and inshore processes. Offshore currents are dominated by the East African Coastal Current (EACC) formed by the northward deflection of the South Equatorial Current when it hits the African mainland in southern Tanzania and northern Mozambique. The EACC flows northwards throughout the year, accelerated during the SEM when reinforced by the prevailing winds to speeds of 0.5-0.75 m/s, and slower during the NEM when the monsoon winds blow counter to the current, at speeds of < 0.25 m/s. At times, southwards-flowing currents may be reported, though the Somali Coastal Current does not penetrate as far south as Mombasa.

Flow of inshore and fore reef waters are strongly influenced by tidal flushing patterns, and tend to flow with prevailing winds rather than the offshore EACC. At the channel entrances, maximum current speeds of approx. 1 ms^{-1} can occur, with ebb currents tending to be slightly stronger than flood currents.

4.2.5 Waves

Wave action is dependent on the direct wind stress of local winds and also arise from swells, significant wave height, bottom friction and depth of water over the fringing reefs. Although waves in the near-shore waters of the entrance to Mombasa port are small, they are common a feature. The largest waves (2 m) occur during the South East Monsoon when the winds are strongest. Within the channel, waves can propagate directly in as far as Fort Jesus, but to the north and south where fringing reefs occur waves first shoal and break on the reef edge and then propagate with new frequencies and amplitude, on the reef platform, beaches and on the coral-cliff banks near Fort Jesus. Tudor Creek is oriented due north and south, thus is more exposed to waves and winds from the rough Southeast Monsoon but is well sheltered from lesser conditions of the Northeast Monsoon.

Wave generation is solely by trade winds, with no cyclones or long ocean swells breaking on the Kenya coast. At the height of the southeast monsoon breaking wave heights > 2-3 m on the coral reefs will prevent inshore cable-laying. The landfall location is highly sheltered by the fringing reefs and convoluted shape of the channel entrance, thus breaking wave height is rarely > 1 m, though extreme chop and conflicting currents can occur.

5.0 MARINE HABITAT AND BIODIVERSITY ASSESSMENT

The Mombasa MNPR harbors a rich marine ecosystems or habitats that includes coral reefs and seagrass beds, providing refuge to important and endangered species such as sea turtles, dugongs, and dolphins.

5.1 Coral reefs

Coral reefs ecosystems are some of the most bio-diverse and productive marine ecosystems that provide an array of ecological goods and services (Constanza et al 2014). Spatially these reefs occur into two distinct habitats, 1) Inner patch reefs, 2) Outer fringing reefs.

Patch reefs occur immediately within the lagoon with depths ranging from less than 1m at low tide to 5-8m. They fringe at leeward side of the reef crest and slopes into the sand and seagrass beds to the shore. Patch reefs are well known for well developed, coral growth and biodiversity, with high cover (60%) of large, massive corals (*Galaxea*, *Porites*), encrusting (*Montipora*) and branching form (*Acropora*).

These patch reefs are characterized by a high diversity of corals, harboring more than 100 species on each of the patch reefs. The main reef patches are close to the cable routes, requiring careful route selection to avoid disturbing these reefs. The patch reefs in the reserve (Nyali) are used extensively for tourism, science, and fishing, implying a high value to many stakeholders. These reefs in both the park and *Galaxea*, reserve are monitored regularly under the KWS' long term ecological monitoring programme. With a high degree of information already collected. They can therefore serve as key sites for monitoring impacts of the project.

The outer reefs starts from the reef crest/reef flat extending from 9-25 m, from which it slopes off into deeper waters (30-200m). The bottom characteristic is mainly a hard rock substrate with coral cover (<45%), mainly *Acropora* and *Echinopora.* Depending on the exact point, the bottom type can also be covered by small coral boulders, fine sediments, soft corals and sand-bottom areas(Figure 9)

Figure 9. Inner patch reefs (left) and Outer reefs (right) within the Mombasa MNPR.

Diversity of organisms is highest on the slope from 15 to 22 m depth, and composed of scattered colonies of soft and hard corals, sponges (including the large barrel sponge *Xestospongia*, and brown macroalgae with heavily epiphytized, ragged leaves. Coral diversity is highest on the reef slope at about 15 m, but is less on the flat top, due to sedimentation. North of the Nyali cable route, reef condition improves towards the park, with healthy well-formed coral reefs that are composed of full coral communities recovering from the 1998 El Niño are found mainly in the marine park, with greater dominance of *Acropora*, *Pocillopora* and varied *faviids*.

Two coral reef areas within the Mombasa MNPR were selected for survey as they are in close proximity with the proposed cable route and could potentially be impacted during the cable installation phase. These two reefs (coral garden and Nyali-coral garden) have been extensively studied as part of a long-term monitoring programme by KMFRI and KWS, and therefore key sites for monitoring impacts of cable installation routes proposed in the South and North section of MNPR.

5.1.1 Coral Garden: Shanzu site

Coral garden is located 1.8km from the proposed cable route. The site is of high conservation importance and popularly used for snorkeling and diving by tourists. The site is dominated by hard coral cover (35%+-29), followed by turf algae (20%+-22) (Figure 10). There were few incidences of dead standing corals recorded indicating the recent impact from coral bleaching events in 2010 and 2016. In terms of coral community, these patch reef have a high diversity of corals, with about 114 species out of 42 coral genera being recorded (Fig. 11). This is slightly less than the diversity found at Kisite-Mpunguti MNPR (236 species out of 58 genera), which host the most diversity of corals in Kenya. The most dominant are *Porites* massive and *Echinopora* colonies and larger than 2m in diameter.

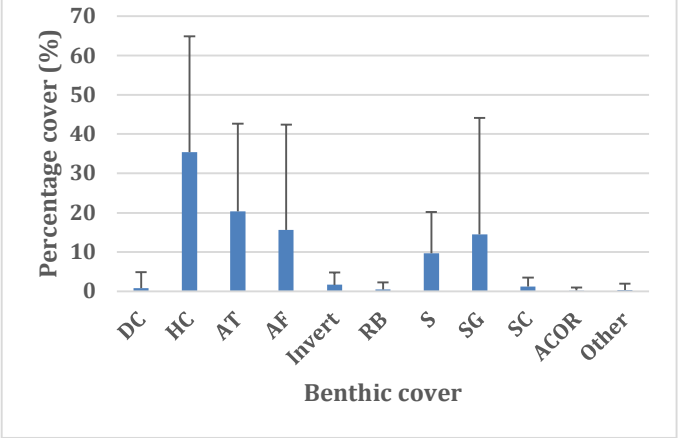


Figure 10 Average benthic cover at coral garden-North MMNPR

Figure 11 Underwater photo showing high coral cover and fish diversity

5.1.2 Coral garden: Nyali site

Nyali-coral garden is on the south end of Mombasa MNR and often visited by glass bottom boats for reef snorkelers and traditional fishing using basket traps and handlines, making it of high value to many stakeholders. These site is characterized by high macro-algae (33%,+-25) and turf algae (24%,+-17), with very low hard coral cover (<10%+-13) (figure 12). Coral diversity is almost the similar to coral garden with 108 species recorded. The dominant genera is *Porites* massive followed by *Favites*. The site is highly influenced by land-use activities such as effluents through ground-water seepages found on the beach and poor water quality from the Tudor mangrove creek flowing outward. The high level of macro-algae/turf and rubble indicate significant disturbance of these reefs, mainly due to proximity to groundwater seepage, high fishing pressure and recurrent bleaching episodes. High coral rubble in the site is attributable to fishing activity using poor fishing methods such as beach seine neting and coral tramplings by speargun fishermen. The fish was observed to be low (4 indiv. per 250m^2) and mainly of small sizes (<15 cm) and less diversity on site.

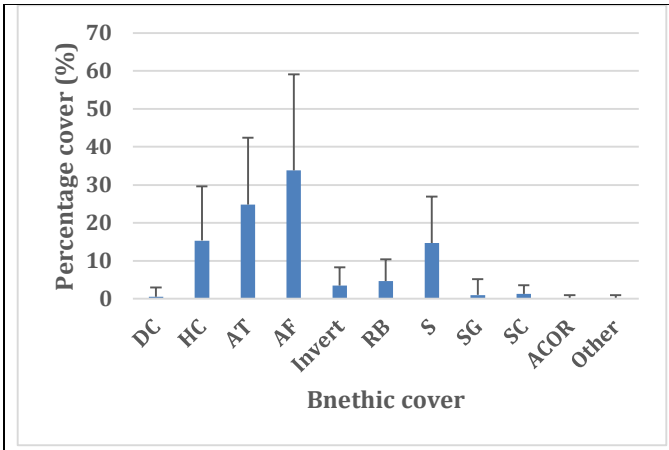
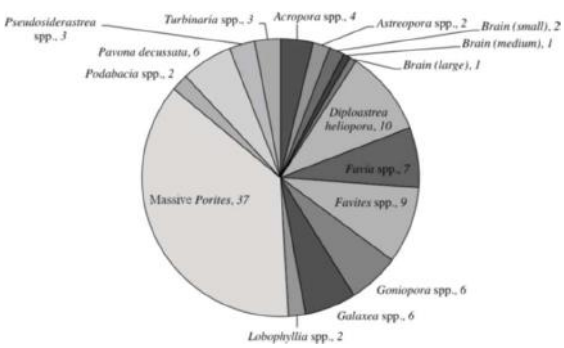


Figure 12. Average benthic cover- Nyali site

Figure 13. Under water photo-Nyali site

Coral diversity



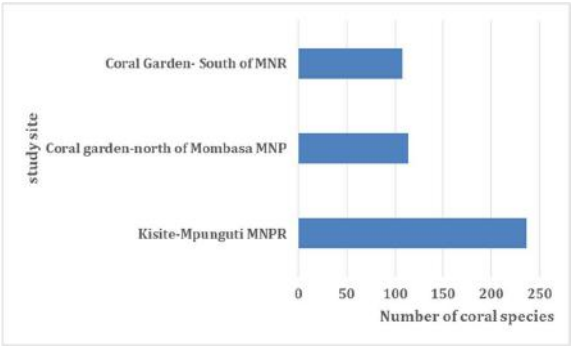


Figure 14. Coral species composition. Figure 15. Coral diversity in 3 kenya coast sites

5.2 Soft bottom substrates

Sandy substrates are found through the reef area. The sand is predominantly large-grained carbonate sand, generated from corals, shells, algae and other organisms growing within the reef system. There is very little terrestrial sediment in the reef system. These substrates contain a diverse assemblage of microbial and interstitial flora and fauna. Sea cucumbers are important macrofauna living in the sandy areas and processing sand for food, and in the Mombasa Marine National Reserve are found as extraction by fishermen is limited for this item. Within the Mombasa Marine National Reserve lagoon, sandy bottoms are made up of clean coralline sand, while in Tudor Creek and Mtwapa Creek they are deep terrigenous silt.

5.3 Seagrass Beds

Seagrass beds are highly diverse assemblages of flora and fauna dependent on sandy and rocky substrates and high light availability in shallow waters. They are the main cover in the Mombasa Marine National Reserve lagoon, from deeper locations in the channel at 8-10 m to the intertidal. Most of the deep (2-8 m) areas are colonized by *Thalassodendron ciliatum*, which provides habitat and food for a variety of fish and invertebrates. Other seagrass species are also found, particularly in shallower sections, including *Halodule, Cymodocea* and *Syringodium*. These shallower seagrass beds extend into the intertidal, where water is retained over them by the structure of the pools/banks on which they grow and give way to the sandy beach at their highest extent.

The seagrass beds near the Nyali lagoon were affected from 2004-5 by an outbreak of the grazing sea urchin Tripneustes gratila, which depleted seagrass beds across the entire southern Kenya coast. The sea urchin increased from natural levels of 1-2 per m2 (Alcovero and Mariani 2002) to over 15 per m2. By 2008 however, the beds had recovered after the overpopulation of urchins died off, demonstrating a high capacity for recovery. Much of the artisanal fishery depends on fish that feed and/or live permanently in seagrass beds, and many of the fishing techniques are adapted for seagrass beds (traps, nets, and beach seines).

Figure 16: Predominant healthy seagrass cover in the park

In the MNP area, *Thalassodendron ciliatum* was the predominant sea grass species(Figure 16) found at intertidal areas; providing nursery, feeding and shelter habitats for a variety of fish and invertebrates.

The sea turtles were also observed during the survey, further emphasizing the importance of seagrass habitats.

Seagrass beds occurred from intertidal area to sub tidal areas near the patchy coral reef.

 **Figure 17. Degraded sea grass habitat-Nyali site**	This is degraded sea beds found at one of the Nyali site in the reserve(figure17). In these site, seagrass beds are subject to anthropogenic and natural disturbances that have led to alterations of the healthy. Nutrient influx through ground seepages has led to their decline as a result of eutrophication at some sections

5.4 Mangrove forest

Mombasa Island is engulfed by two main tidal creeks, the Port-Reitz and Tudor Creeks that are lined with an extensive mangrove forest. These creeks open to the south of the MPA at the English Point. A mall mangrove stands line the shore near the mouth of Tudor creek. To the north of the Mombasa Marine Park (1,000 ha) the creek mangrove community is composed of mangrove trees that grow on low lying sedimentary shores and form well-developed forests that may show species zonation. *Rhizophora mucronata* and *Ceriops tagal* are dominant and represented in almost all mangrove formations. The rare species are *Heritiera littoralis* Dryand and *Xylocarpus moluccensis* (Lamk.) Roem. (Macnae, 1968; Kokwaro, 1985; Dahdouh-Guebas et al., 2000; Kairo, 2001). A strong zonation of species controlled by the tidal regime, yields the following typical pattern from the sea to land: *Sonneratia alba* J. Smith, *R. mucronata*, *Bruguiera gymnorrhiza* (L) Lam., *Ceriops tagal* (Perr) C. B. Robinson, *Avicennia marina* (Forssk.) Vierh., Xylocarpus granatum König, *Lumnitzera racemosa* Willd. and *H. littoralis* is common (Kairo, 2001).

The 2Africa cable does not land near any mangrove forest. The nearest mangrove forest from the Northern cable landing is 2 kilometres while the southern landing is 2.7 kilometres (Figure 18). The cable therefore does not have any potential adverse impacts on the mangrove forests in Mombasa.

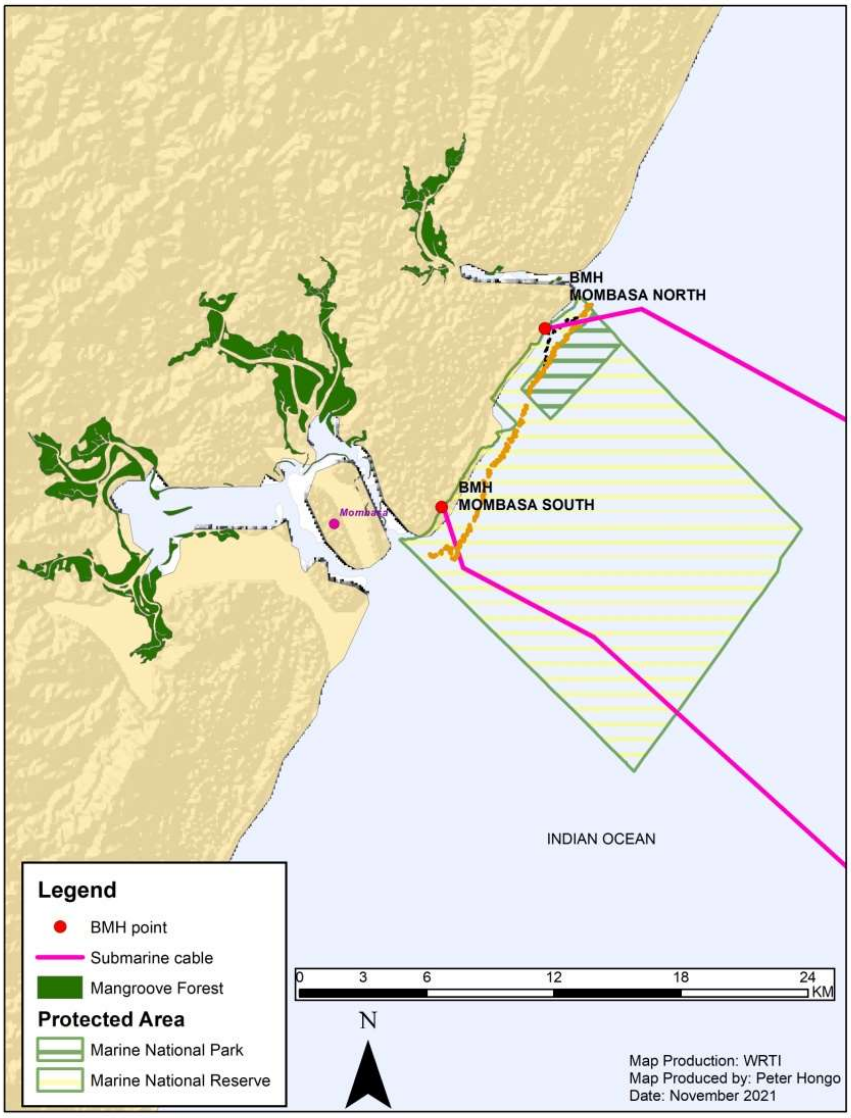


Figure 18 Cable route in the MPA relative to nearest Mangrove forest

5.5 Sandy beaches

Kenya is renowned for its gentle sloping to steep beaches characterized by white calcareous sand of marine origin (coral sand). The sandy beaches are important recreational sites for tourists and a key resource in development of the tourism sector in the country. Beach tourism in Mombasa County occurs primarily in three popular areas, Nyali, Bamburi and Shanzu area, stretching some 13.5km. In the three locations, hotels have been built along the shorelines in response to increased tourist demand and most have encroached to the delicate sandy beach ecosystem.

The sandy beach ecosystems are also important habitats for diverse fauna including sea turtles, birds and marine invertebrates among others. Species diversity on sandy beaches is however

usually low. On the higher parts of the beach, above the high water line, only a few burrowing crabs and amphipods are usually found. The density and diversity of crabs, bivalves, polychaetes and other marine invertebrates increases in the intertidal, but remain low compared to most other habitats. Waste materials stranded along the beaches may attract a variety of foraging waders and other birds. Sandy beaches serve as nesting sites for sea turtles. Green turtles, hawksbill and the rare olive ridley all nests on Kenyan beaches. While previously sea turtle nesting was common on beaches in Mombasa County, they are infrequently seen currently due to modifications of the shorelines and beaches.

Formation and characteristics of the sandy beaches is influenced by the two distinct wind regimes experienced in the coast region; the northeast monsoon occurring from December-April and the southeast monsoon from May-November. The wind seasons are influenced by semiannual passage of the Inter-Tropical Convergence Zone (ITCZ) which further influences the bimodal rainfall maxima. Waves in the near shore are produced by the local winds or originate from the swells produced by distant storms. Waves are generally small and continually change with changes in wind direction, speed configuration, and tidal levels. There are two tide levels (high and low) during the day with a tidal period of about 12 hours, 25 minutes, and a tidal range of about 2-3 m.

The project sites occur within the extensive Nyali and Shanzu sandy beaches located on latitudes -4.056 and -3.968 and longitudes 39.704 and 39.756 respectively. Beyond the sandy beach is system of rocky shores and hanging cliffs. The beach area lies at an altitude of less than 30 m above sea level and experiences severe erosion at 2.5-20 cm/y that threatens coastal development.

Figure19:Beach erosion along Shanzu beach

5.5.1 Nyali Beach

The Nyali beach is located on latitudes -4.056 and -4.045 and on longitudes 39.704 and 39.712. The area lies at an altitude of about 33.13m above sea level and stretches to about 1.8km. It is characterized by quartzitic terrigenous fine sands of grain sizes of between Φ2.83- Φ2.63. The grain sizes tend to be coarse during the northeast monsoon and fine during the southeast monsoon seasons. Nyali beach is gently sloped at 3.34^0-2.62^0 and the

width range between 64.44m and 80.16m. The beach experiences swash velocities of about 0.54-1.76m/s and backwash of between about 0.54 and 1.44m/s during the southeast monsoon regime, and swash from 0.76 to 1.18m/s and backwash between 0.62 and 1.21m/s throughout the northeast monsoon. Wave energy at Nyali beach varies with changes in the monsoon winds and range from 153.23 to 324.67 joules.

Developments along the beach include residential apartments and tourist hotels. There are few sea defense barriers along the shoreline and small vegetation including *Ipomea pes caprae* and an invasive cactus plant, the *Opuntia* sp. line the beach. Sea turtle nesting has reportedly decreased in the area to about 8 nests currently. The beach is heavily utilized for tourism and recreational activities as well as for fish landing.

Figure 20 Ipomea pes caprae Spp.along Nyali beach

Figure 21.Opuntia Spp. along Nyali beach

5.5.2 Shanzu Beach

Shanzu beach is adjacent to Mombasa MPA and lies within latitudes -3.977 and -3.968 and longitudes 39.749 and 39.756. It occurs at an altitude of about 22.94m above sea level and extends to approximately 1.3km. The beach comprise of moderately well sorted and mesokurtic medium to fine sand with grain size ranging from Φ1.99 to Φ1.84. The beach is characterized by calcareous coarse sand and shell fragment, and has relatively steep slope of 5.49^0-4.18^0 and narrow width of between 29.51 and 44.41 m. The beach experiences low swash and high backwash velocities. The swash and backwash velocities range from 1.42 to 2.01 m/s and 1.31 to 2.01 m/s respectively during the southeast monsoon regime, and swash from about 0.97 to 1.83 m/s and backwash from about 0.73 to 1.97 m/s respectively during the northeast monsoon season. Wave energy at the beach ranges from 136.01 to 374.89 joules.

The shoreline is lined with a number of hotel complexes including Prideinn, Serena Beach, Continental resort, Flamingo, and the Dolphin hotel which is still under construction. Most of the hotels have completely encroached upon beach area that had previously been used for sea turtle nesting through construction of seawall and revetments, and only few of the unmodified

beach sections are currently utilized for nesting. Tourist activities including beach walking, curio selling and sporting are also prevalent on the beach.

5.6 Turtle nesting sites

Three sea turtle species commonly feed and lay eggs on the Kenya coast – the hawksbill turtle (*Eretmochyles imbricata*), the green turtle (*Chelonia mydas*) and the olive ridley turtle (*Lepidochelys olivacea*) (Okemwa et al., 2004). They feed in the lagoons and lay eggs (nest) at the edge of the highest tide zone on sandy beaches. While previously common around Mombasa, as elsewhere, they are now infrequently seen. The main causes of decline are mortality of adults from illegal and incidental fishing, mortality of eggs and hatchlings by predators on the beaches, and loss of feeding grounds (seagrass beds) and modification of the natural shoreline and nesting beaches (Okemwa et al., 2004).

Sea turtles used to commonly nest on the beaches between Mtwapa Creek and Tudor Creek. However, due to loss of nesting grounds by erection of seawalls and installation of lights along the beach, turtles currently nest in specific sites along the stretch, these include English Point, Mkomani in the south, the Nyali beach stretch, the stretch in between (Reef Hotel, White Sand and Milele Beach Hotel), and Shanzu beach (PrideInn, Serena, Intercontinental and Dolphin Beach Hotels).

KWS rangers in collaboration with the hoteliers and community scout survey the beach to identify and record nesting sites. Safe turtle hatcheries have been identified in Nyali Serena and PrideInn. Eggs laid in unsafe nests are usually relocated to the hatcheries to protect them and increase the survival of the hatchlings.

High nesting season is usually between April and September and in the last 12 months a total of 48 nests have been recorded out of which 36 (75%) were recorded in Nyali and Shanzu (Table 6).

Table 6: Sea turtles nesting frequency along the MPA Sandy beach

MONTH	MIDDLE	NYALI	SHANZU	SOUTH	TOTAL
JANUARY			3		3
FEBRUARY			3		3
MARCH	1		6		7
APRIL		1	6	2	9
MAY		2	2	2	6
JUNE		3	2		5
JULY		1		3	4
AUGUST	1	1		2	4
SEPTEMBER	1				1
OCTOBER			1		1
NOVEMBER			2		
DECEMBER			3		
TOTAL	3	8	28	9	48

Since turtles are endangered species the proximity of the cables in their habitat trigger environmental safeguard measures that ensure the net effect of the project does not lead to any population decline of the species. It was noted that the temporary nature of cable installation activity and the associated footprint upon installation are of very low magnitude and very unlikely to affect the species or their habitat significantly. Adequate information on the project habitat interaction is however useful to ensure utmost care is taken when laying the cable. The turtles nesting areas are well known (Figure 21.) and active monitoring is in place to secure the eggs and the sites.

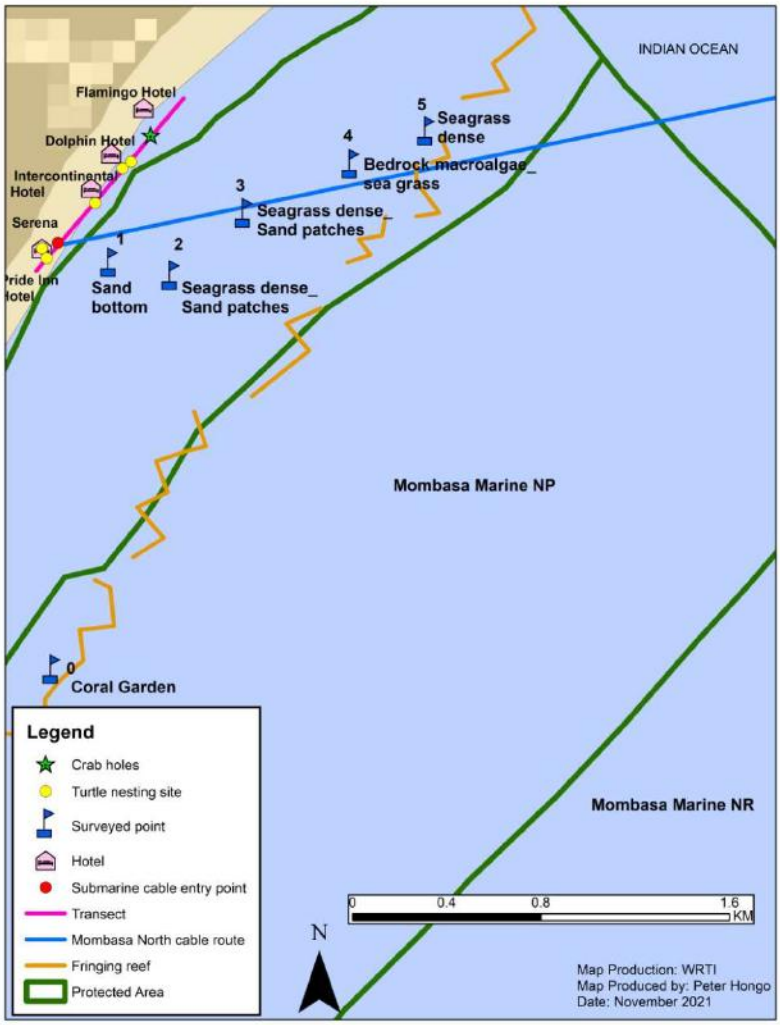


Figure 21 Turtle nesting sites near the Northern landing site at Shanzu.

As turtles feed on benthic plants and animals, they have been known to pick at debris and plastics, and to consume brightly coloured objects (hawksbill turtles feed on sponges, which may be brightly coloured). Thus they may bite at structures in the water, such as the cable, particularly if brightly coloured and if loose tape/structures waft in the water. It is therefore recommended that the cable should not be brightly coloured.

5.9 Marine megafauna

Though not documented during the current surveys, previous report indicated that Blue whales and sharks are commonly cited offshore of the fringing reefs and rarely come into inshore(pers.obs). Humpback whales migrate north and south along the Kenya coast annually, being frequently sighted off Malindi and Shimoni. As top-level predators, they impact on local food webs and ecosystems as a whole and serve as important indicators of the health of marine environment. The Mombasa MNPR has been reported to be a part of the home-range for dolphins and sea turtles (Kws 2016).

5.10 Invertebrate fouling communities

Rocky surfaces on the edges of Tudor creek are covered by a variety of invertebrates, mainly sponges, ascidians and soft corals, all of which feed primarily by filtering particulate food out of the water column. These communities have developed over several decades as water quality in the creeks has declined, as hard coral communities were found in the late 1980s in front of the KMFRI compound about 2 km upstream on the Mkomani side.

5.11 Fisheries

Traditionally, the coastal communities have depended on fisheries for a livelihood. Currently it is estimated that about 10,000 fishermen are directly engaged in artisanal fishing along the Kenyan coast. Fishing effort has increased with increase in the number of artisanal fishermen over the years. Effort is limited by lack of information on fisheries potential, little institutional support for fisheries development, lack of investment interest in the fisheries sector due to the perceived poor returns in investment in this sector compared to alternatives such as tourism, poor infrastructure and market, use of small inefficient traditional fishing vessels, most of which are un-motorized wooden-planked

5.12 Visual assessment of marine habitat within the cable route

The entire shallow portions of the two cable routes through the Mombasa MNPR.
The northern cable crosses the park at a little distance (approx. 500m) traversing reef rock areas with little corals and then later pass through dense seagrass beds on intertidal areas (Figure 22).

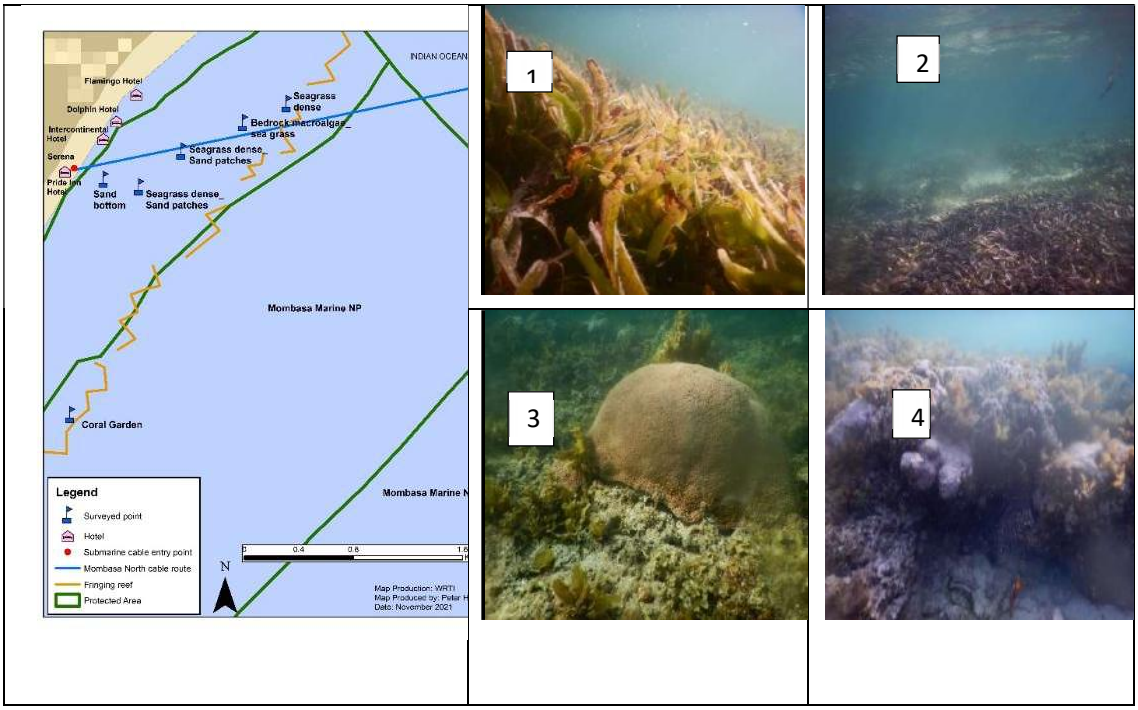


Figure 22 Figure 9 A map of recent sampling points of the habitat status at the Northern cable route through the MPA.

The map in Figure 22 shows the north cable route crossing Marine Park and the underwater photos shows the benthic type recorded at the several sites close or along the proposed cable route during routine assessment.

ii) The southern cable route crosses Nyali coral garden where coral cover is low (<10%), then through a lagoon characterized by dense seagrass to the HWM

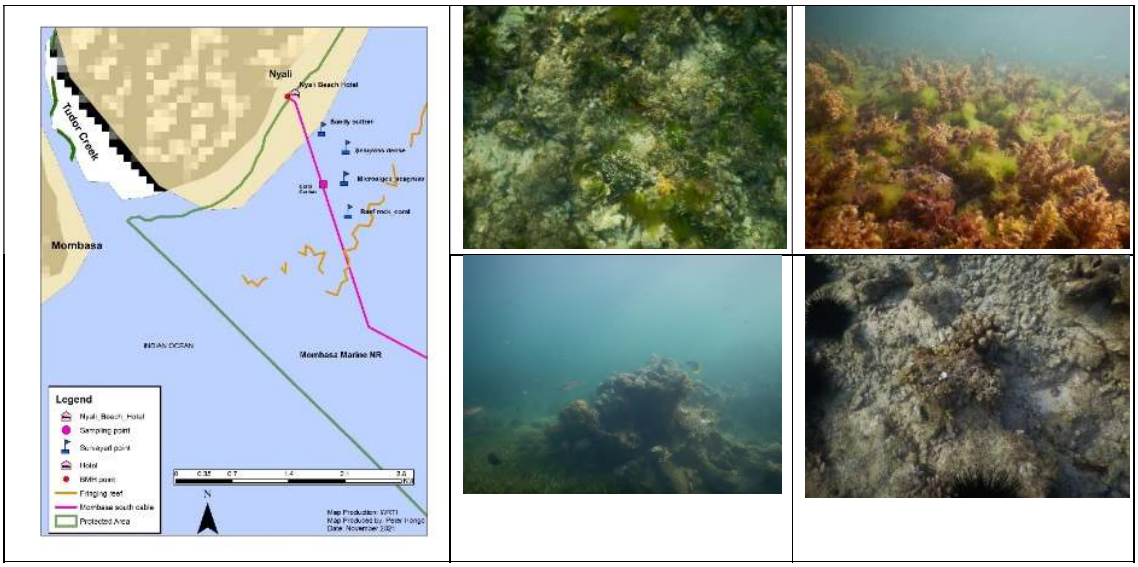


Figure 23 A map of recent sampling points and images of the habitat status (Northern cable route through the MPA)

Figure 16 shows a map showing the south cable route crossing Marine Reserve. The underwater photos shows the benthic types recorded at the several sites close or at the proposed cable route.

5.13 Ecosystem Services

Coral reefs and seagrass habitats are important in providing shelter, nursery and feeding grounds for a variety of fish and invertebrates and other biodiversity. Much of the artisanal fishery depends on fish that feed and/or shelter in seagrass and coral reefs within MNPR. Tourism is one of the primary sector in Mombasa, with Mombasa MNP and MNR being two prime sites for snorkeling, glass-bottom boating and SCUBA diving. Primary snorkeling grounds and diving sites include the coral gardens in the park in the north of MNP (1km-2km far from the cable route), and Nyali patch reefs.

6.0 POTENTIAL ENVIRONMENTAL IMPACTS

6.1 Positive Impacts

The proposed submarine cable may not have any direct positive impacts to the marine habitat upon installation. The additional hard substrate along the seafloor is negligible compared to area of natural substrates and the artificial nature of the cable might promote fouling/invasive communities as opposed to natural ones.

However the cable will enhance reliable internet connectivity that promotes better communication and technological advances in marine research and species monitoring. This can indirectly contribute to increased understanding of the species in the MPA leading to better biodiversity conservation and management intervention that may ultimately result to net gain in biodiversity in the long run.

6.2 Negative Impacts

The preferred method of cable laying in the MPA will be directly on the substrate surface or laid around larger coral colonies (>2m in diameter). Corals are highly sensitive to any form of abrasion and sediment smothering.

Thus possible impacts are the following:

i. Physical abrasion and breakage during cable laying on substrate surface or around coral colonies
ii. Smothering by sediments from anchoring and/or cable laying operations nearby or carried by water currents
iii. Sensitive species such as sea turtles and dolphins may be impacted or disturbed while roaming freely in their natural habitats during cable laying operations.

6.2.1 Turbidity

Excavation to lay and bury the cable may cause disturbance to the sea bed stirring particulates settled on the sea bed thus increasing water turbidity. However this impact is very temporal because the particles settle back with time. Turbidity is the measure of degree to which water is murky and is caused by particulate matter ranging from sediments to phytoplankton. Highly turbid ocean waters are those with a large number of scattering particulates in them. Visibility into the water is reduced due to the scattering particles after disturbance. This have some negative impact on the pelagic production but the effect is negligible because organisms are used to occasional turbidity caused by other factors including ebbying and sediment inflow from rivers. This impact is considered short term and reversible with the likelihood of affecting important habitats being very occasional.

6.2.2 Noise pollution

Most wildlife species in the marine environment are sensitive to noise. Sub marine cable installation work involves the use of heavy machinery and equipment that will cause a certain degree of noise pollution. This impact is minimal and short term to be experienced only during the construction phase. Studies have however shown that impulsive noise produced by ships

during route survey can cause behavioral disruption, and discomfort to certain sea species. For instance a 6-hour of continuous low frequency noise exposure of 120dB causes behavioral disruption to whales and dolphins. The impact is however minimal and almost negligible because the cetaceans have adapted to cruising ship boats through avoidance over the years.

6.2.3 Impact fishing

The Mombasa marine Reserve is a key fishing zone and the submarine cable installation through this vital habitat for fish may indirectly affect fishing. The coral gardens are important fish habitats and any interference may affect fish breeding and diversity. However this impact is unlikely because it can be avoided during route designing and cable laying. Social concerns from fisherman on interference with their fishing activities during installation and also in the event that the cables is dislodged from the benthic substrate and get suspended in water. Suspended cables affect boating activities and can result to boat accidents.

6.2.4 Potential Interference with Turtle nesting

The landing sites of the submarine cables are not very far from turtle nesting sites within Nyali and Serena sand beaches. Turtles are critically endangered and a number of species are of high conservation concern. There are three species of turtles that breed within the project area of influence. These are the green turtle the hawksbill and the rare Olive ridley. The turtle nesting sites are however well known and therefore the cable laying exercise can avoid tampering with sites to the extent possible.

6.2.5 Accidental Spills

Accidental spills from the ship may occur during laying operations. The vessels that lay the cable use fossil fuel to operate and could contaminate marine water through leakages and or accidental spills. Oil spills penetrate the structure of the plumage of birds and the fur of mammals, reducing their insulating ability, and making them more vulnerable to temperature fluctuations and much less buoyant in the water. Coral reefs and mangroves are also affected by accidental spills. The spills also may indirectly affect marine species

6.2.6 Degradation of corals

Corals are highly sensitive to any form of abrasion and sediment smothering. The north cable branch/route passes approximately 500m through the Mombasa MNP along a seagrass bed and reef rock areas with few scattered coral heads across intertidal platform. Potential impacts on corals include physical breakage during cable laying, dredging operations, ship anchoring or accidents, Smothering by sediments from dredging/cable laying operations nearby or carried by water currents from upstream locations, Toxic impacts from release of pollutants in sediments, cable properties or oil spills.

6.2.7 Waste discharge from work vessels

Work vessels are a potential source of waste generated by the crew and if the waste is not properly disposed it can lead to environmental pollution. Some waste both solid and liquid can adversely affect marine life leading to organism mortality and biodiversity loss.

Other potential impacts that may affect biodiversity although not likely to occur include disturbances due to magnetic radiation, marine mammal entanglement by dislodged cable and collision of installation vessels with large sea mammals like the whale shark and dolphins. This species are seasonal and their movement predictable and hence these impacts are avoidable.

6.2.8 Impacts on ecosystem services

Sites of tourism and recreational value within the MPA lie to the north of the cable route. Important sites are a surfing site on the tip of the reef at English Point, dive sites on the outer reef and snorkeling sites within the lagoon. The Northern cable landing site is adjacent to the KWS revenue gate where community boat operators pay to take guests into the park and Reserve for the recreation activities. Cable installation vessels and workers on site may affect these visitor activities lowering their level of satisfaction. This is however a relatively low impact particularly if there is adequate planning, consultation and coordination between the proponent, KWS , boat operators and the beach hoteliers during project implementation.

Nyali is a public beach where the neighboring community come for recreation and the cable installation activities could lower the public enjoyment of the beach and hence will need to be avoided. Coral reefs and seagrass habitats are important in providing shelter, nursery and feeding grounds for a variety of fish and invertebrates. Fishing is a key subsistence and economic activity for the beach community and MPA contributes in all the four ecosystem services provisioning, supporting, regulating and cultural. The nature of the project is neither extractive nor obstructive and does not constitute any removal of natural habitat cover hence very minor impact on ecosystem services.

6.3 Impact rating and significance analysis

In identifying the potential impacts of the 2-Africa submarine cable installation on biodiversity an impact matrix focusing on sensitive habitats and species potential interaction with the project was prepared. Rating and scaling of the impacts based on the methodology described in section 2.4 above was employed

Table 6-1. Potential Negative impacts analysis

Potential Impacts	Ecological receptor	Sensitivity	Magnitude	Likelihood	Duration	Scale	Reversibility
		Not sensitive	Negligible	Remote	Short term	Local	Reversible
		Low	Minor	Unlikely			
		Medium	Moderate	Occasional	Medium term	National	Irreversible
		High	Major	Likely	Long term		
Turbidity: Excavation and backfilling during cable lying on the continental shelf. Debris	Marine life within	Not sensitive	low	occasional	Short-term	Local	Reversible

Clearance and ploughing of the sea bed to bury the optic cable.	the continental shelf						
Trenching effect. Onshore cable laying involve digging a trench and backfilling on the beach to the landing site	Sandy beach macro inverte brates	Not sensitive	negligible	unlikely	Short-term	Local	reversible
Noise Pollution. Surface Lay Operations utilizing cable ship heavy equipment may have acoustic emissions from ships during the cable laying process can cause noise pollution to marine life.	Marine life	Medium	low	likely	Short-term	Local	Reversible
Accidental spills Accidental spills from the ship may occur during laying operations. The vessels that lay the cable use fossil fuel to operate and could contaminate marine water through leakages and or accidental spills	Marine life	High	low	likely	Short term	national	reversible
Benthic disruption Sediment dispersion in the physical cable laying processes cause disturbance of the habitats	Sea bed	Not sensitive	negligible	Occasional	Short term	Local	Reversible
Marine life movement disruption	Mega fauna	High	Low	Unlikely	Short term	Local	Reversible

Shipping Equipment and machinery during installation and in the event of dislodged cables can disrupt movement of mega fauna in the ocean Trenching across the sand beach to the cable landing site can interfere with turtle movement to the nesting site Dolphins can also be impacted or disturbed while roaming freely in their natural habitats during cable laying operations.							
Strumming effect This effect may be felt both during and after the cable has been laid it involves the cable moving across the ocean floor due to currents or as it is being pulled by the cable laying vessel.	Sea Bed, seagrasses	Not sensitive	negligible	likely	Short-term	Local	irreversible
Physical smothering and abrasion of Corals	Coral reef	sensitive	low	Occasional	Short term	Local	Reversible
Beach Erosion	Sandy beach	sensitive	negligible	occasional	Short term	local	Reversible
Interference with Ecosystem services	MPA	Not sensitive	low	occasional	Short term	National	Reversible

6.4 Mitigation of Negative impacts

In the designing of the project it is recommended that the mitigation hierarchy is followed to the extent possible in the order of 1) avoidance 2) Reduction 3) restoration and finally 4) offsetting of residual impacts.

Potential Impacts	Mitigation Measures	Area of the project	When
Turbidity: Excavation and backfilling during cable lying on the continental shelf. Debris Clearance and ploughing of the sea bed to bury the optic cable. Turbidity can affect pelagic production.	• Specify anchoring requirements/restrictions during operations with procedures for minimizing damage to bottom substrates and prohibiting anchoring close to sensitive habitats (waters < 6-8 m depth). • Cable installation in the vicinity of coral habitat will take place within appropriate sea-state conditions and tidal conditions (i.e., water level at the reef); to be defined in consultation with KWS.	Marine Reserve	During cable installation
Trenching effect. Onshore cable laying involving digging a trench and backfilling on the beach to the landing site	• Design trenching/laying activities to as narrow a corridor as possible and restore site and specify this in the cable-laying specification. • Backfill to original contour with original material as per cable laying specification • Confine trenching/laying activities to as short a period as possible	Intertidal zone(Reserve & Park) to the Beach Man Hole(BMH)	Cable installation
Noise Pollution. Surface Lay Operations utilizing cable ship heavy equipment may have	• Safe operational procedures identified and documented during cable-laying operations • Sensitize vessel operators on potential encounter with mega fauna to avoid disruption of their movement • Confine construction to work hours.	Beach , Reserve and Park	During cable installation Installation to take place in

acoustic emissions from ships during the cable laying process can cause noise pollution to marine life.	• Abide by the Resolution MSC 337(91) code on noise levels on board ships • At the shallow water segment the cable installation should avoid night time when turtles come to nest • Abide to EMCA noise and vibration regulations during onshore activities		daylight hours
Accidental spills Accidental spills from the ship may occur during laying operations. The vessels that lay the cable use fossil fuel to operate and could contaminate marine water through leakages and or accidental spills	• Endorsement and adoption of Kenyan Oil Spill mitigation measures adopted under OSMAG, with particular reference to limitations on use of dispersants in shallow waters. • KPA and OSMAG to be informed in advance during cable-laying to be alert to contain any oil spill incidents that may occur. • Comply with the MARPOL guidelines. • Contain all fuel, lubricants and transmission fluids in double walled tanks on vessels and if in drums, store below deck. • Maintain a contingency plan to address spills, pollutants and cyclones. • Design all fuel, lubricants and transmission fluids storage in type-approved tanks or drums in a secure bund area.	All areas within the exclusive economic zone	Operation period of the installation vessels
Benthic disruption Sediment dispersion in the physical cable laying processes cause disturbance of the habitats	• Confine disturbance to as narrow a path as possible as per cable laying specification. • Specify anchoring requirements/restrictions during operations with procedures for minimizing damage to bottom substrates and prohibiting anchoring close to sensitive habitats (waters < 6-8 m depth). • Undertake trenching only within 2hrs of low tide as per cable laying specification. • During beach trenching, store soil and aggregate away from drainage areas.	Soft benthic substrate in the Reserve	Cable laying process
Impact on Marine species	• Avoid onshore turtle nesting sites. The identified route must not be located on a prime habitat for benthic organisms.	Sandy beaches &	During cable installation

Shipping Equipment and machinery during installation and in the event of dislodged cables can disrupt movement of mega fauna in the ocean Trenching across the sand beach to the cable landing site can interfere with turtle movement to the nesting site Dolphins can also be impacted or disturbed while roaming freely in their natural habitats during cable laying operations.	• The installation period should be as short as possible to minimize on interruption of fishing activities and disturbance of the marine species. • Turtle nest monitoring will be conducted within the Project footprint prior to installation to check for turtle nests and recent turtle activity. The timing (i.e., days in advance of beach works) and details of turtle monitoring will be coordinated with KWS to meet Kenyan requirements. If active nests and/or nesting attempts are observed by monitors, appropriate mitigation measures—for example, temporary fencing and monitoring during beach works—to avoid nest disturbance will be taken by the Project in consultation with KWS. • Work with KWS rangers and turtle and community scouts to undertake early morning monitoring of turtle tracks on the beach as they go to nest and ensure that nesting and eggs are secure during cable installation on the beach. • A Marine Megafauna Protocol shall be developed and implemented in coordination with KWS; this may include, for example: o A response plan in the event of megafauna collision o Implementing a safety zone and/or speed restriction on the sighting of pods of whale species, bait balls (i.e., large, tightly packed formations of fish) or slow-moving megafauna such as Whale Sharks	Intertidal zone and the continental shelf Within the Park and Reserve	
Degradation of corals	• The cable installer will coordinate with KWS in advance of and during the pre-lay swim, to refine the cable alignment within the Mombasa MNR. • Cable installation in the vicinity of coral habitat will take place within appropriate	Mainly in the Reserve	

	sea-state conditions and tidal conditions (i.e., water level at the reef); to be defined in consultation with KWS. • Adopt cable-laying procedures that minimize re-suspension and transport by wind and currents of sediments to these habitats.		
Strumming effect (lateral movement of the Cables) This effect may be felt both during and after the cable has been laid it involves the cable moving across the ocean floor due to currents.	• Avoidance of sensitive marine habitats • Adopt cable-laying procedures that minimize re-suspension and transport by wind and currents of sediments to these habitats. • The tension and weight of the cable, at > 6 kg per metre, helps to maintain the cable in position on the seabed except in extremely high-energy environments (> 4 knot perpendicular current). • If the cable engineers determine that cable movement is likely, clamps will be applied to further secure the cable to the seabed. KWS may also review clamp recommendations during pre-installation coordination.	Both Continental shelf zone with soft benthic substrate mainly in the reserve	Installation and operation period

7.0. CONCLUSION AND RECOMMENDATIONS

Based on the above findings most of the potential impacts of marine biodiversity conservation concern relating to the 2-Africa submarine cable installation in Kenya can be avoided. These impacts relate to potential damage to any sensitive habitat that may be on or near the cable route and that would be impacted by sediment plumes; pollution release and/or shipping accidents; disruption of recreational and/or tourist and fishing activities during cable installation and impact of wastes generated during operations. These can all be avoided through appropriate operational procedures, including notifications of affected parties, and rerouting the cable outside notable coral reef community. The company contracted for the cable installation need to be keen on the environmental safeguards and safety plans to be followed during project implementation. The northern cable landing at Shanzu was found to be more environmentally sensitive although it's only 2.5 km stretch through the MPA compared to the southern cable landing route which 15.5 km through the MPA.

The cumulative impacts from multiple fibre-optic cables passing through the same route in the MPA can also be significantly minimized through coherent planning between the cable projects. The proponents need to engage relevant authorities particularly Kenya Wildlife Service, Wildlife Research and Training Institute, the National Environment Management Authority and Kenya Marine Fisheries Research Institute and Telkom Kenya during route survey and subsequent project stages to optimize project environmental sustainability.

Most of the other identified potential impacts related to marine habitats are highly localized short-lived and will be hardly noticeable after the cable is laid and operationalized. These impacts are of relatively low magnitude and can be minimized to negligible levels through implementation of the suggested measures. Such include localized disturbance to habitats along the cable route itself and impacts can only be felt a few meters to either side of the cable. Soft substrate communities should recover through natural succession, while reef communities some of which are already highly degraded as evidenced by low hard coral cover and low fish diversity especially a section of the southern cable route. We opine that the very nature of the project activities is short lived and not intrusive on the natural habitat during the cable operation. The habitat disturbance caused during installation of the submarine cable is within the ecosystem resilience and thus is unlikely to have a net loss effect on biodiversity

Finally, there are residual impacts of the submarine cable in the MPA. As described above, residual impacts after implementation of best management practices and mitigation, are expected to be minor or negligible in nature. The offsets for these residual effects are not implemented directly on the project site but instead constitute a conservation fee that will indirectly contribute to management of the impacts. For instance, the MPA is under routine security surveillance and ecological monitoring that enhances the biodiversity conservation. The surveillance could also partly contribute to the protection of the cables against any potential vandalism particularly within the MPA. Upon approval of the ESIA the proponent will obtain a way-leave through the MPA from KWS and pay the required conservation fee.

REFERENCES

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Mwaura J., Karisa J., Said O. M., Olendo M., Katello J., Ong'anda H., Nyunja J., Ambae R., Murage D., Mussembi S., Obura D., Kamula J., Ngisiange N., Katua S. (2017) Kenya national chapter In Coral reef status report for the Western Indian Ocean (2017).

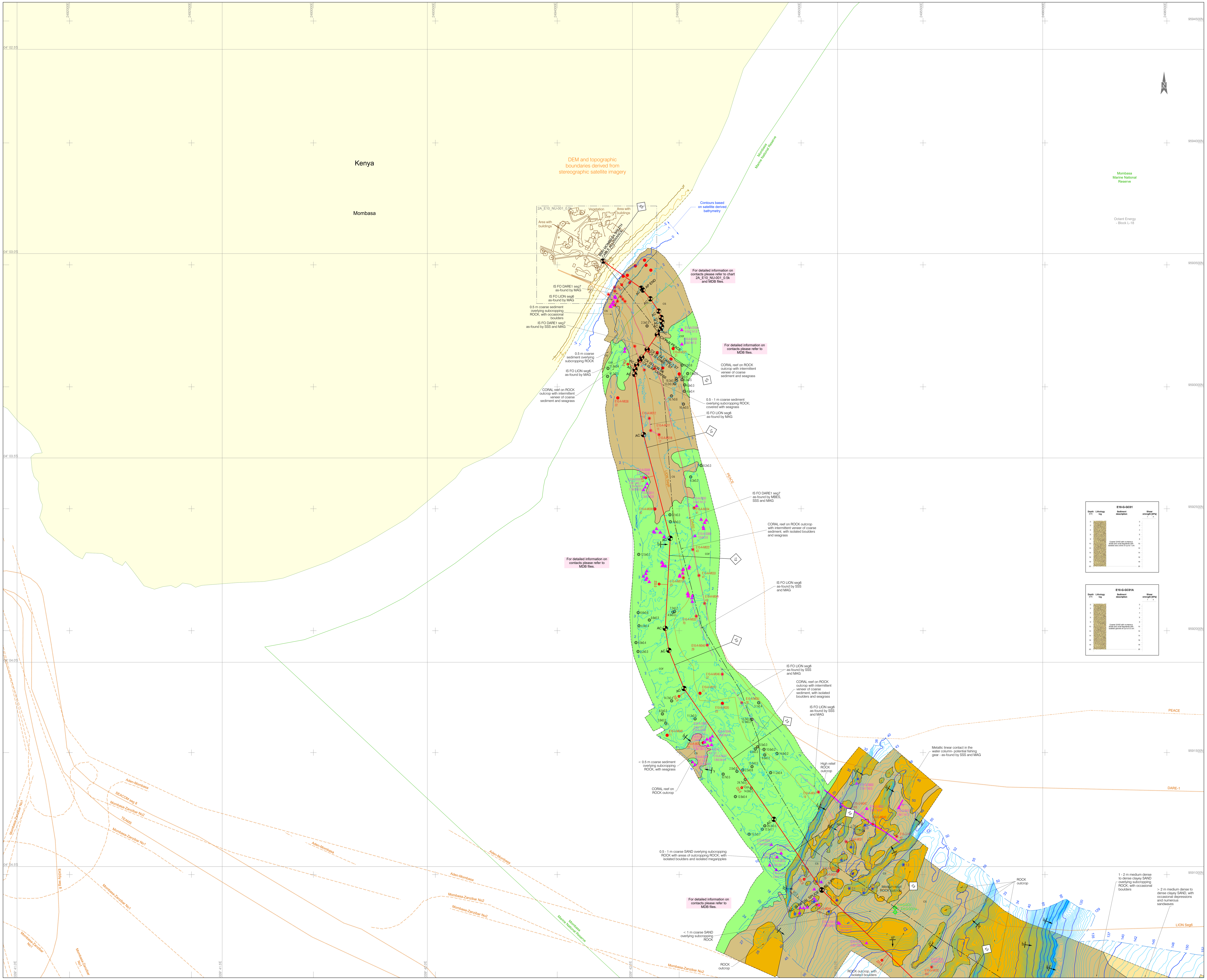
Costanza R., d'Arge R., De Groot R., Farber S., Grasso M., Hannon B., NaeemS., Limburg K., Paruelo J., O'Neill R.V., Raskin R., Sutton P., van den Belt M.(2014) The value of the world's ecosystem services and natural capital. Nature,287, 253-260.

Mwaura, J., Umezawa, Y., Nakamura, T. and Kamau, J. (2017) Evidence of chronic anthropogenic nutrients within coastal lagoon reefs adjacent to urban and tourism centers, Kenya: A stable isotope approach. Marine Pollution Bulletin 119: 74-86.

Alcoverro T, Mariani S. (2002). Effects of sea urchin grazing on seagrass (Thalassodendron ciliatum) beds of a Kenyan lagoon. Marine Ecology Progress Series 226: 255-263.

KWS 2016..Mombasa MNPR plan

Appendix B2
Fugro Marine Report



CARTOGRAPHIC SYMBOLS

- Post survey route with kilometre post and reverse kilometre post
- Alter course / Point on line / Beach manhole (BMH) — AC, POL, BMH
- Contractual route
- Chart matchline
- Coastline (from Admiralty Charts)
- Telecommunications cable position, In-service/Out-of-service/Planned (As found in magenta)
- Pipeline position, In-service/Out-of-service/Planned (As found in magenta)
- Power cable position, In-service/Out-of-service/Planned (As found in magenta)
- Unknown cable
- Maritime boundaries
- Submerged wreck / Exposed wreck / Obstruction / Well / Platform / Explosives dumping ground and symbol or line feature in grey, plotted from desk top study (as-found in magenta). (for general symbols and abbreviations refer to British Admiralty Chart)

BATHYMETRY

- Bathymetric contours in metres. Contour interval may be reduced to aid in clarity.
- Downslope gradient in degrees (°) as measured over the shortest significant distance
- Approximate limit of swath bathymetry coverage (shown only in areas of flat seabed)
- 93.8 Spot depth

SEABED FEATURES AND SHALLOW GEOLOGY

- cor — Coral
- fs/cs/vcs — Gas seepage area with predominant sediment classification
- fs/cs/vcs — Boulders with predominant sediment classification

Loose Sediments:

- fs — Fine sediment (predominantly CLAY/SILT)
- cs — Coarse sediment (SAND and GRAVEL)
- vcs — Very coarse sediment (COBBLES and BOULDERS)

Rock:

- fs/cs/vcs — Subcropping ROCK with predominant sediment classification (sediment thickness < target burial depth)
- r — ROCK outcrop (with veneer of sediments)
- hs — HARDGROUND (very dense/very stiff/ consolidated sediments; sediment thickness < target burial depth)

- Sediment or feature boundary
- Inferred sediment or feature boundary
- Approximate limit of side scan sonar coverage
- Seabed scar or trawl scar
- Anchor scar
- S1-V-S001 2.5x1.3x0.4 — Isolated sonar contact with reference no. (length x width x height in metres where measurable; nmh = no measurable height)
- 25.0 — Linear sonar contact, dashed where partially buried; with length in metres.
- S1-V-M002 5 — Unidentified magnetic anomaly with reference number and amplitude in nanotesla (nT)
- S1-V-M001 150 — Cable/Pipeline position, as determined by magnetometer, with reference number and amplitude in nanotesla (nT)
- S1-V-S002 20.0x10.5x7.5 — Located wreck with reference no. (length x width x height in metres where measurable)
- S1-V-GC01 — Seabed sample location with ref. no.: GC (Gravity Core) PC (Piston Core) GS (Grab Sample) BP (Beach Probing)
- S1-V-CP01 — CPT location with reference number
- 0.5 — Small outcrop of rock with height in metres if discernible
- 10.0/1.2 — Seabed depression or pockmark with diameter (d) and depth (D) in metres, where discernible
- 50.0/3.0 — General orientation of sandwave crest (Hachures on lee side where observable, with wavelength and height in metres)
- 4.0/0.8 — Orientation of megaripple crest (Hachures on lee side where observable, with wavelength and height in metres)
- Orientation of sediment ribbon
- -25.0 — Fault with depth below seafloor (Hachures on footwall)

CHART COMMENTS:

Cable and Pipeline Crossings:
CX PLN PEACE (database): KP: 0.035, water depth: 0 m, crossing angle: 9°
CX PLN PEACE (database): KP: 0455, water depth: 3 m, crossing angle: 43°
CX IS FO DARE 1 (as-found): KP: 0.537, water depth: 3 m, crossing angle: 58
CX IS FO LION 2 Seg 6 (as-found): KP:0.596, water depth: 3 m, crossing angle: 54°

Hazards/Remarks:
The seabed sediments mainly comprise CORAL reef on ROCK outcrop with intermittent veneer of coarse sediment and seagrass. An area of subcropping ROCK covered with coarse sediment in present in the northernmost part. The seabed sediments in the southeastern part of the chart consist of outcropping and subcropping ROCK covered with coarse SAND. Steep to very slope gradients are observed and isolated boulders are present throughout.

GENERAL NOTES:

Survey Vessel :	MV Fugro Gauss	MV Alumaster
Navigation Systems :	Seapath 330+	POS MV WAVEMASTER
Underwater Pos. Systems :	Kongsberg HiPap 351	--
Motion Sensor :	Seapath 330+ incl. MRU 5+	POS MV WAVEMASTER
Bathymetry :	Kongsberg EM 122 / EM 710 MkII	EdgeTech 6205
Seabed Feature / SBP :	EdgeTech 4200 / Knudsen 3260	EdgeTech 6205 / Innomar SES2000 compact
Magnetometer :	G-882 AR/4	G-882 AR/4

Descriptive Terms and Definitions:
The criteria used for interpretation and descriptions are presented in the Survey Report.

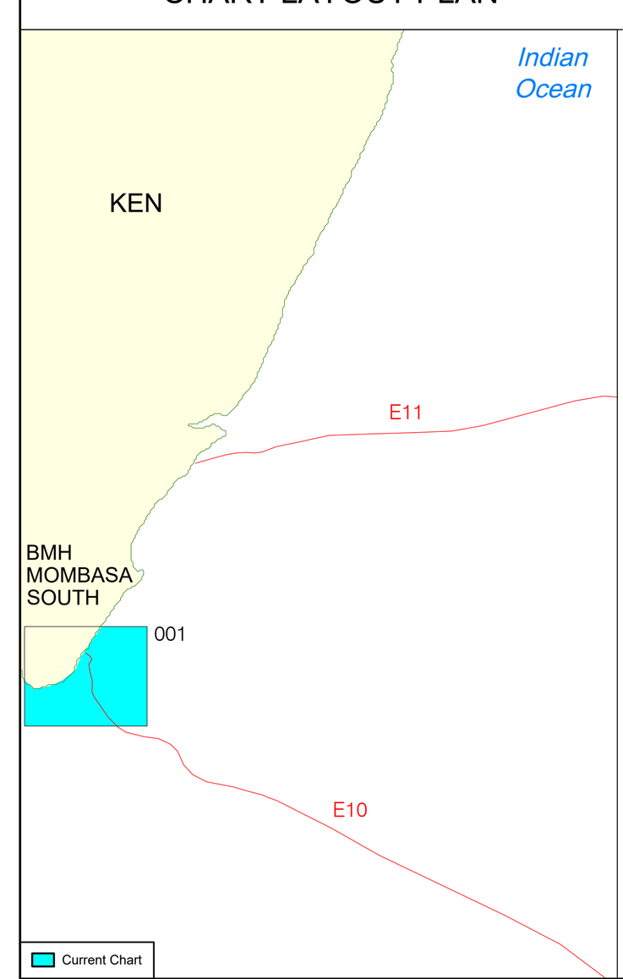
Bathymetry & Tide:
Depths in metres, reduced to Lowest Astronomical Tide (LAT).

Satellite Derived Bathymetry:
The data from Satellite Derived Bathymetry is provided "as is". Users bear all responsibility or liability for any loss or damage arising out of any use of it. FGMG does not give any warranties with respect to accuracy or errors in the data.

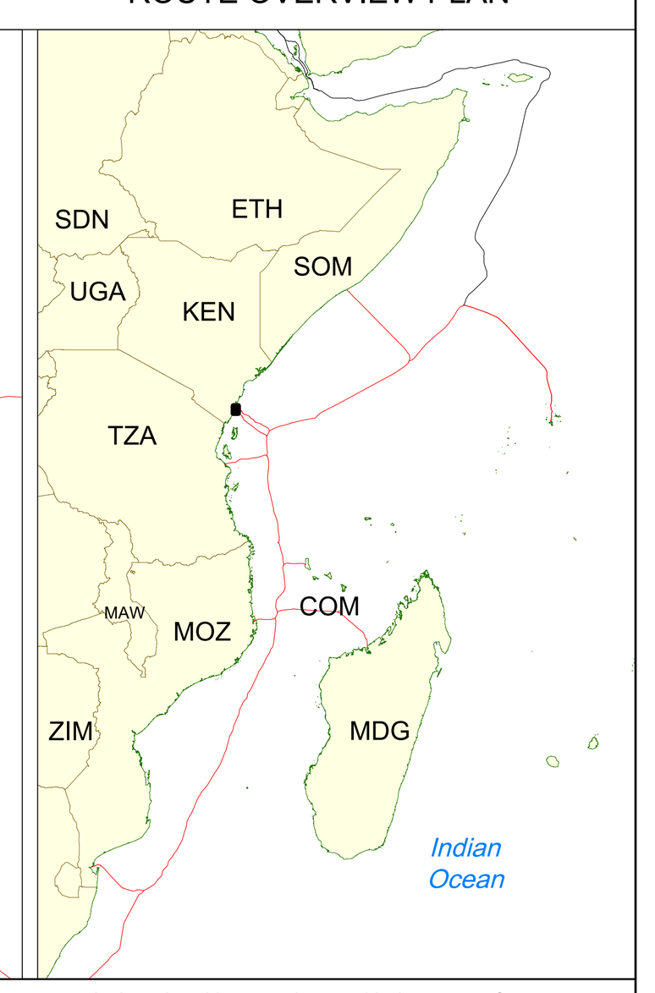
GEODETIC PARAMETERS:

Projection:	Mercator	Longitude of Origin :	15° E
Datum:	WGS84	Standard Parallel :	25° S
Semi-Major Axis:	6 378 137.000 m	False Easting :	0 m
Inverse Flattening (1/f):	298.257 223 563	False Northing :	10 000 000 m
	(Up to IRD 1/f=298.257 224)	Scale Factor :	1

CHART LAYOUT PLAN



ROUTE OVERVIEW PLAN



Survey Date: December 2020 - January 2021

Scale : NATURAL SCALE 1 : 5 000 AT 25°S

0 100 200 300 400 500m

Scale 5499.848567 at mid-latitude of chart

Contractor : ALCATEL SUBMARINE NETWORKS

Surveyor : FUGRO

Fugro Germany Marine No.: 203-20-675

Project Name: **2AFRICA**
Cable Route Survey

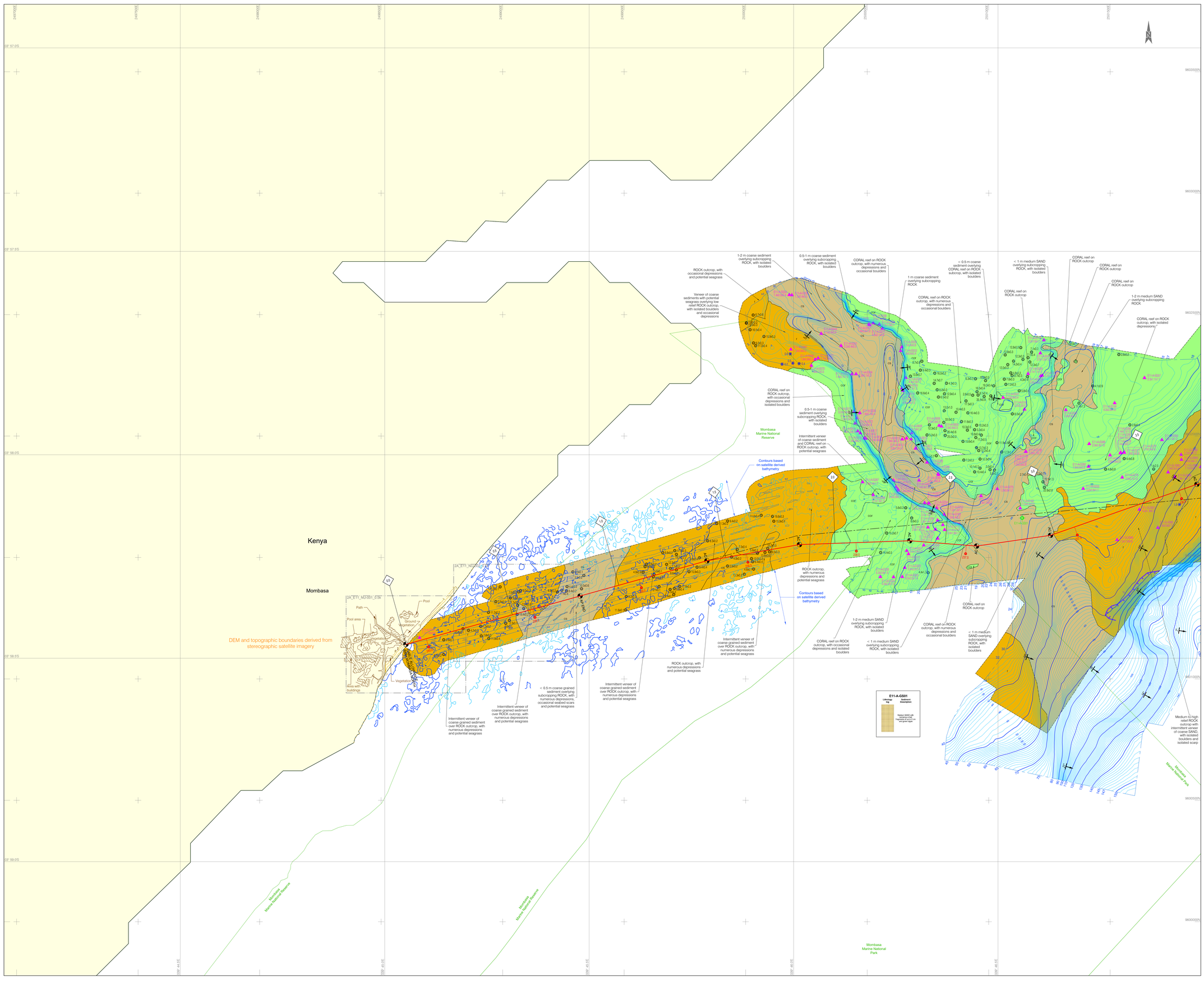
Document Title:
SEGMENT E10
BMH MOMBASA SOUTH to BU MBS
NORTH UP CHART NO. 001 OF 001
(KP 0.000 to KP 3.784)

Rev	Date	Prepared by	Checked by	Approved by
1.0	12.03.2021	IE	MN	BW
0.0	29.01.2021	LK / MS	MN / SR	BW

REVISION 1

ROUTE BASED UPON: 2AF_E10_BMH MOMBASA SOUTH - BU MBS_PSR03_15-FEB-21.xls

File Name: 2A_E10_NU-001_5k



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- Chart matchline
- Coastline (from Admiralty Charts)
- Telecommunications cable position, In-service/Out-of-service/Planned (As found in magenta)
- Pipeline position, In-service/Out-of-service/Planned (As found in magenta)
- Power cable position, In-service/Out-of-service/Planned (As found in magenta)
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- Maritime boundaries
- Submerged wreck / Exposed wreck / Obstruction / Well / Platform / Explosives dumping ground and symbol or line feature in grey, plotted from desk top study (as-found in magenta). (for general symbols and abbreviations refer to British Admiralty Chart)

BATHYMETRY

- Bathymetric contours in metres. Contour interval may be reduced to aid in clarity.
- Downslope gradient in degrees (°) as measured over the shortest significant distance
- Approximate limit of swath bathymetry coverage (shown only in areas of flat seabed)
- 93.6 — Spot depth

SEABED FEATURES AND SHALLOW GEOLOGY

Loose Sediments

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- CPT location with reference number
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- General orientation of sandwave crest (Hachures on lee side where observable, with wavelength and height in metres)
- Orientation of megaripple crest (Hachures on lee side where observable, with wavelength and height in metres)
- Orientation of sediment ribbon
- Fault with depth below seafloor (Hachures on footwall)

CHART COMMENTS:

Cable and Pipeline Crossings:

None

Hazards/Remarks:

The charted area is characterised by outcropping and subcropping ROCK and CORAL reef with boulders and depressions. Slope gradients are gentle to very steep throughout the chart.

GENERAL NOTES:

Survey Vessel :	MV Fugro Gauss	MV Alumaster
Navigation Systems :	Seapath 330+	POS MV WAVEMASTER
Underwater Pos. Systems :	Kongsberg HiPap 351	--
Motion Sensor :	Seapath 330+ incl. MRU 5+	POS MV WAVEMASTER
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Depths in metres, reduced to Lowest Astronomical Tide (LAT).

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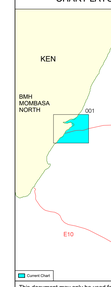
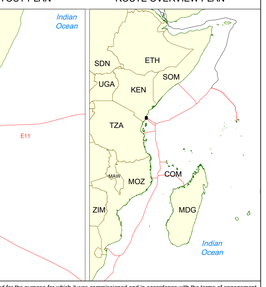
Inverse Flattening (1/f):	298.257 223 563 (Up to IRD 1/f=298.257 224)	False Northing :	10 000 000 m
		Scale Factor :	1

CHART LAYOUT PLAN



ROUTE OVERVIEW PLAN



Survey Date: December 2020 - January 2021

Scale : NATURAL SCALE 1 : 5 000 AT 25°S

0 100 200 300 400 500m

Scale 5500.461016 at mid-latitude of chart

Contractor : ALCATEL SUBMARINE NETWORKS

Surveyor : FUGRO

Fugro Germany Marine No.: 203-20-675

Project Name: **2AFRICA**

Cable Route Survey

Document Title:

SEGMENT E11

BMH MOMBASA NORTH - BU MBN

NORTH UP CHART NO. 001 OF 001

(KP 0.000 to KP 3.700)

Rev	Date	Prepared by	Checked by	Approved by
1.0	19.03.2021	RMJ	MN	BW
0.0	25.01.2021	LK / MS	MN / SR	BW

REVISION 1

ROUTE BASED UPON: 2AF_E11_BMH MOMBASA NORTH - BU MBN_PSR03_ 16-FEB-21.xls

File Name: 2A_E11_NU-001_5k

Appendix C ToR Approval Letter from NEMA

Website: www.nema.go.ke

NEMA/TOR/5/2/270

28th June 2021

Managing Director
2Africa Consortium.
P.O Box 76485-00508
NAIROBI

RE: ACKNOWLEDGEMENT AND APPROVAL OF TERMS OF REFERENCE (TOR) FOR ENVIROMENTAL IMPACT ASSESSMENT

We acknowledge the receipt of TOR for the above subject.

Pursuant to the Environmental Management and Coordination Act, 1999 the second schedule and the Environmental (Impact Assessment and Audit) Regulations 31 and 35, your terms of reference for the Environmental Impact Assessment (EIA) for the proposed **2AFRICA SUBMARINE CABLE PROJECT IN MOMBASA COUNTY**, has been approved.

You shall submit ten (10) copies, a soft copy summarised version of the ESMP in **WORD** form and one electronic copy of your report prepared by a registered expert to the Authority.

MARRIAN KIOKO
FOR: HEAD EIA SECTION

AIRTEL NETWORKS KENYA LIMITED

Parkside Towers, Mombasa Road, Nairobi
Kenya

4th November, 2021

Marrian Kioko
National Environmental Management Authority
PO Box 67839,
00200 Popo Road
Nairobi
Kenya

Dear Madam,

RE: TRANSFER OF RESPONSIBILITY FOR PERMIT APPLICATION AND ENVIRONMENT LICENCE

We refer to the above matter and to 2Africa consortium companies' letter of 19th March 2021 and to your letter of 28 June 2021.

We now write to inform you that Airtel Networks Kenya Limited (Airtel) is the local landing provider in Kenya for the 2Africa consortium and will assume responsibility for the permit application process and the consequent Environment Licence. We request that you update you records accordingly to reflect this.

In support of the transfer of responsibility please find enclosed herewith the following documents for your kind perusal and records;

1. Certified Official Status Report (formerly Form CR12) for Airtel Networks Kenya Limited; and
2. Certified Certificate of Change of Name.
3. Certification by the Project Proponent (Airtel)

By way of further background, please note that Alcatel Submarine Networks SAS (ASN) has been awarded the contract for the design, installation and commissioning of the repeated fibre optic submarine cable system. ASN, as part of their responsibilities, will therefore be responsible for identifying, investigating and securing (where applicable) the permits and consents, licenses, and supporting environmental documentation required for the installation and operation of the cable system. The ASN-appointed environmental subcontractor for these activities is AECOM and its local partner is Norken International. We request for your assistance introduction of ASN and AECOM to the necessary Ministries and Authorities for their information and action as appropriate.

We trust that this is in order and thank you for the continued kind indulgence and support.

Yours faithfully,

PD Sarma
Managing Director

Appendix D Certificate of Incorporation for Airtel Networks Kenya Limited

THE REPUBLIC OF KENYA

BUSINESS REGISTRATION SERVICE
P. O. BOX 30031
NAIROBI
11 JAN 2021

To
AIRTEL NETWORKS KENYA LIMITED
P.O. Box 3085
00100 - G.P.O NAIROBI

THE COMPANIES ACT, 2015

Records relating to the below company held by the Companies Registry as at **11 Jan 2021**

..

COMPANY	AIRTEL NETWORKS KENYA LIMITED
COMPANY NUMBER	C.140223
NOMINAL SHARE CAPITAL	25,961,513,000.00
NUMBER AND TYPE OF SHARES (VALUE PER SHARE)	ORDINARY A: 2625000 (KES 1,000.00 EACH) ORDINARY B: 725000 (KES 1,000.00 EACH) PREFERENCE A: 3500000 (KES 1,000.00 EACH) PREFERENCE B: 6700000 (KES 1,000.00 EACH) PREFERENCE C : 1863653 (KES 1,000.00 EACH) PREFERENCE D: 2294573 (KES 1,000.00 EACH) PREFERENCE E: 4367201 (KES 1,000.00 EACH) PREFERENCE F: 3886086 (KES 1,000.00 EACH)
DATE OF REGISTRATION	24TH FEB, 2003
REGISTERED OFFICE	P.O BOX 73146 TELEPHONE: , EMAIL: COUNTY: , DISTRICT: , LOCALITY: STREET: PARKSIDE TOWERS, MOMBASA ROAD, BUILDING: LR NO. 209/11880
POSTAL ADDRESS	P.O BOX 73146
ENCUMBRANCES	

Name of Directors and Shareholders of the above company with their particular are as follows

NAME	DESCRIPTION	ADDRESS	NATIONALITY	SHARES
ALOK BAFNA	DIRECTOR	P.O BOX 73146 CITY SQUARE	INDIA	
PRASANTA DAS SARMA	DIRECTOR	P.O BOX 962 G.P.O NAIROBI	INDIA	
DADDY BUJITU MUKADI	DIRECTOR	P.O BOX 73146 CITY SQUARE	CONGO - KINSHASA	
BHARTI AIRTEL AFRICA B.V.	SHAREHOLDER	P.O BOX OVERSCHIESTRAAT 65,1062 XD AMSTERDAM NETHERLANDS	N/A	ORDINARY A: 1 ORDINARY B: 0 PREFERENCE A: 0 PREFERENCE B: 0 PREFERENCE C : 0 PREFERENCE D: 0 PREFERENCE E: 0

Certified to be a true copy
SCRIBE SERVICES SECRETARIES

Partner

03 June 2021

BHARTI AIRTEL KENYA B.V	SHAREHOLDER	P.O BOX OVERSCHIESTRAAT 65,1062 XD AMSTERDAM NETHERLANDS	N/A	2624999 PREFERENCE A: 3500000 PREFERENCE B: 6700000 PREFERENCE C : 1863653 PREFERENCE D: 2294573 PREFERENCE E: 4367201 PREFERENCE F: 3886086
IAN FERRAO BASIL	DIRECTOR	P.O BOX 962 - 00100	UNITED KINGDOM	
BERNARD KIRAGU KAMAU	SECRETARY	P.O BOX 3085 G.P.O NAIROBI	KENYA	ORDINARY A: 0
			TOTAL	25961513

Yours Faithfully,
REGISTRAR OF COMPANIES

REF NO: OS-B2FX8VL9

DISCLAIMER: THIS IS A SYSTEM GENERATED CERTIFICATE AND DOES NOT REQUIRE A SIGNATURE

Certified to be a true copy
SCRIBE SERVICES SECRETARIES
Partner
03/June2021

Appendix E Copy of Land Title Deed/ Agreement

Land negotiations are being finalized between the Project Proponent and the landowner for the BMHs. Final copy of title deed/agreement will be supplied once completed.

Appendix F Minutes from Public Consultation and Participation Meetings

Stakeholder Engagement

For this Environmental Impact Assessment (EIA), engagement consisted of two main stages: a first round of stakeholder engagement (informative) and a second round of engagements (consultative).

These activities were carried out by the local consultants (Norken) for the period between October 2020 and November 2021; further information on each stage is outlined below. All meetings undertaken as part of this EIA study have been documented in the form of meeting minutes, registers and photographs (where possible). Below is a summary of the stakeholder engagement.

First Round of Stakeholder Engagement

These engagements were primarily conducted during the reconnaissance visit to Mombasa in between 26 October 2020 to 4 November 2020. Virtual calls were also set up to engage the stakeholders when it was not possible to meet in person due to restrictions in observance of the novel coronavirus, COVID-19.

The purpose of this first round of engagement was to inform the stakeholders and potentially affected parties at the Project site of the client's intention to install the 2Africa submarine cable system. The stakeholders were identified during preliminary stakeholder mapping and analysis. The team sought the guidance of these stakeholders on the Project's environmental and social sensitivities and permitting requirements to inform the Project's design, and to guide subsequent engagements during the actual EIA study. The stakeholders consulted are listed in Table 1.

Table 1: List of stakeholders consulted during first round of engagement

Date	Time (EAT)	Stakeholder	Venue
26/10/2020	10:00 – 11:00	Coast Development Authority	Virtual Meeting
27/10/2020	9:00 – 11:00	Site Reconnaissance Shanzu	Beach Management Unit (BMU) Mombasa North
	11:30 – 12:45	National Museums of Kenya (NMK)	NMK Mombasa Town Offices
	14:30 – 15:30	Kenya Wildlife Services (KWS)	KWS Mombasa Town Offices
	16:00 – 17:00	County Fisheries Department	County Offices Liwatoni
28/10/2020	10:00 -10:30	County Commissioner (CC) Mombasa	CC's Office
	11:00 – 12:00	National Environment Management Authority (NEMA) Offices Mombasa	Kenya Forest Services (KFS) Building First Floor, Left Wing
	12:30 – 13:15	KFS Mombasa	KFS Building First Floor, Right Wing
	14:30 – 16:00	Site Reconnaissance Nyali	BMU Mombasa South
29/10/2020	9:30 – 10:30	Kenya Coast Guard Services (KCGS)	KCGS Offices Liwatoni
	15:45 – 16:15	Fisheries	Fisheries Offices Liwatoni
30/10/2020	10:45 – 11:30	Deputy County Commissioner (DCC) Kisauni Subcounty	DCC's office Bamburi
	12:00 – 12:45	Assistant Chief Shanzu	Chief's Office Shanzu
	13:30 – 14:00	Chief Nyali	Chief's Office Bombolulu

Date	Time (EAT)	Stakeholder	Venue
	14:00 – 15:00	Village Elder Nyali	Beach Road Nyali
	16:00 – 17:00	Focus Group Discussion, BMU Shanzu	Shanzu Beach
31/10/2020	16:30 – 17:45	BMU Nyali	Early Bird Nyali Beach
4/11/2020	14:30 – 15:00	Coastal Oceans Research and Development – Indian Ocean (CORDIO) East Africa	Virtual Meeting

Feedback from first round

Twenty meetings, both virtual and physical, were successfully conducted in the first round of engagements. Two of these meetings were focus group discussions with BMUs; one with the Shanzu BMU and the other with the Nyali BMU.

The main aim of the fora was to provide a platform for key informants to share experiences in similar scenarios, give their views on the proposed Project, suggest sustainable approaches and recommend impact mitigation and enhancement measures for consideration by the Consultant and the Proponent. The participants supported the proposed Project because they perceived it as having more benefits than negative impacts.

Overall, the stakeholders emphasized the importance of assessing the marine conditions to ensure that the anticipated Project impacts are minimized and mitigated.

Table 2 summarizes the comments raised by key informants and the corresponding responses given by the Consultant during the first round of engagements.

Table 2: Summary of Outcomes from One-on-One Consultations

Institution	Name	Summary of Comments Received Where Applicable	Summary of Responses/Actions
KWS	Mr. John Wambua Senior Warden Mombasa Marine Park	KWS will need to do an ecological assessment of the route along the marine park to ensure that sensitive habitats such as corals are not impacted.	The Project needs to write a letter to the Director General (DG) KWS, indicating that this meeting was held in Mombasa and that the consultant was to submit the plan of work for the assessment undertaken by KWS. The Project will share seabed bathymetric survey outcomes.
NEMA (Nairobi HQ)	Mr. Joseph Makau Environmental Officer NEMA	The Project triggers an EIA report because it is categorised as a medium-risk project.	The Project team will conduct an EIA in accordance with NEMA requirements and guidelines
NMK	Mr. Philip Wanyama Archaeological Officer Mr. Caesar Bita	The NMK will need to carry out a heritage assessment of the cable route to ensure that it does not go through a marine archaeological site.	A letter will be written to the DG in Nairobi outlining the scope of work, if required. Based on review of the Fugro marine study, no heritage sites are anticipated to be in the area of influence of the Project.
Kenya Maritimes Authority	Mr. Tony Cheruiyot Head of Marine Safety Mr. Michael Mbaru Environment Officer	• There are navigational aids along the coast, and the team undertaking the installation should be made aware of them. • Regular reporting to the Regional Maritimes Search and Rescue Centre for all activities should be carried out, with a report within a day of activities. • Maritime notice should be sent to Kenya Maritime Authority (KMA) for planning and to communicate with other marine users regarding the cable installation.	• During installation of the cable, the 2Africa team should be aware of the navigational aids along the coast; light towers should be used to guide the captain. • During cable installation, there is risk to navigation and local users in the area—for example, to fishermen and other people engaged in boating activities. A marine notice should be issued and used by KMA to give notice to marine users. The notice should be given at least 2 weeks before the activities commence. The notice should provide details of the Project (e.g., the day and time the activity will take

Institution	Name	Summary of Comments Received Where Applicable	Summary of Responses/Actions
			place, and the vessel used to lay the cable). • A letter requesting issuance of the notice should be sent after plans are finalised for the Project. • Regular reports should be made to the Regional Maritimes Search and Rescue Centre regarding all the activities carried out. Reports should be made within 1 day, and all incidences need to be reported to the Centre. • The Project should consider seasonal activity when laying the cable because there will be different levels of activity in deep/shallow water at different times of year. This will help avoid obstructing fishermen and other users. • This information can be obtained from the fisheries department. • The cable ships will need to be inspected by KMA officers to confirm their seaworthiness to operate in Kenyan waters. This inspection is usually undertaken in Mombasa. • The inspection will include an examination of the ship operators to determine their skills and qualifications to undertake such work. • Details regarding the vessel registration and specification will be provided to KMA, who will then send the information to the Kenya Coast Guard and the Navy.

Institution	Name	Summary of Comments Received Where Applicable	Summary of Responses/Actions
Coast Development Authority	Mr. Simon Lokitari Environment Officer	• Consider clarifying to stakeholders the safety aspects of submarine cables being laid close together. • Consider clarifying the techniques that will be used to lay the cables.	• During the EIA stakeholder engagements/ consultation, ensure that the area of interest is known. • During EIA engagements, consider clarifying the safety aspects of submarine cables being laid close together. • During EIA engagements, consider clarifying the technique that will be used to lay the cables.
National Lands Commission	Mr. Ben Opaa Acting Director, Natural Resource Management	The Project team should engage with the Communications Authority of Kenya (CA)/ The Ministry of Information, Communications and Technology (ICT), who will then write a letter to the National Lands Commission to provide consent for the cable to be laid on the seabed of the Exclusive Economic Zone (EEZ).	Noted.
KFS	Ms. Jenipher Nasombi Forest Conservator	The KFS Mombasa office should visit the two sites to ensure they are not located on forest areas.	Formal communication needs will be sent to the Chief Conservator of Forests, who will send the officers to the site to determine whether the Project locations are forest areas.
County Fisheries Department	Mr. Simon Losepicho Director County Fisheries	The Project team should involve the BMUs during the installation period. Formal engagements should be done through barazas and posters.	The Project team may need to acquire scientific data from the Kenya Marine and Fisheries Research Institute (KMFRI) on ecological studies and potential impacts to specific species. Research that has been done for other studies can be borrowed for this Project.
CORDIO East Africa	James Mbugua Project Manager	The cable route could be rerouted to pass along the gaps in Shanzu reef.	Inform them of Project progress; no other action item.

Institution	Name	Summary of Comments Received Where Applicable	Summary of Responses/Actions
	David Obura Director CORDIO East Africa		
Kenya Coast Guard	D.M. Mwambui, D.K. Cheruiyot	• To date, the Authority has not encountered issues regarding the cable. • The Authority will be involved during cable installation through regular patrols. The Project team should notify them to provide security during the installation period.	• KCGS will be notified once all permits are obtained. The vessel's manifest will be shared, including details of the crew, nature of cables being laid, and estimated times of arrival and departure.
CC Mombasa	Mr. Gilbert Kitiyo	The chiefs of the affected areas need to be consulted through the respective DCCs.	During major Project development or works, the Project team will inform the CC's office in advance of activity.
DCC Kisauni Sub-County	Mr. Cyrus Gatobu	The DCC arranged for the meetings with the Chiefs and the BMUs.	In accordance with the chiefs' requirements, a formal invitation will be forwarded to the CC, who will forward it to the chiefs via their respective DCCs and ACCs.
BMUs (Shanzu and Nyali)	Mr. G.M. Mbuba, Ms. Pamela Makabong'o	The Project team should involve the BMUs during cable installation.	• The BMUs will be notified of any Project works or future engagements 1 month in advance. •
State Department of Fisheries	Ms. Elizabeth Mueni Assistant Director	The Project team should communicate with stakeholders during public consultation and explain how the installation will be done.	The EIA report will have a 'Fisheries' section, describing the fisheries ecosystem.

Second round of stakeholder engagement

This round introduced the Project to primary and secondary stakeholders. The engagement involved a combination of virtual meetings and in-person meetings and were held between 21 September 2021 and 3 November 2021.

The stakeholders engaged during this stage are listed in Table 3.

Table 3: List of stakeholders consulted during second round of engagement

Date	Stakeholder	Mode of Engagement
21-Sep-21	State Department of Fisheries, Aquaculture and The Blue Economy	Virtual Meeting
29-Sep-21	KMFRI	Virtual Meeting
30-Sep-21	Kenya Ports Authority (KPA)	Virtual Meeting
05-Oct-21	Assistant County Commissioner (Nyali)	In person Meeting
05-Oct-21	Deputy County Commissioner Mbuba (Shanzu)	In person Meeting
05-Oct-21	Mombasa Land's Registry	In person Meeting
06-Oct-21	Chief Nyali	In person Meeting
07-Oct-21	Chief Shanzu	In person Meeting
19-Oct-21	KFS	Virtual
29-Oct-21	CA	Virtual
06-Oct-21	Nyali BMU	In person Meeting
06-Oct-21	Nyali BMU Representative	In person Meeting
07-Oct-21	Shanzu BMU	In person Meeting
07-Oct-21	Shanzu BMU Chairperson	In person Meeting
19-Oct-21	KFS	In person Meeting
28-Oct-2021	Mombasa Country Commissioner	Letter
02-Nov-21	KWS	Virtual Meeting
03-Nov-21	Communication Authority of Kenya	Virtual Meeting

The consultant also made efforts during the second round of engagement to engage the stakeholders listed in Table 4 below, which are mainly government institutions. Multiple attempts at contact were made, but no response was received. In a subsequent effort to engage the stakeholders, the consultant sent letters that included the Project brief and requested that stakeholders submit their feedback within a 14-day period. As of the issuance of this report, however, the consultant had not received feedback from these stakeholders. Copies of the letters sent to these stakeholders are appended to this report.

Table 4: Stakeholders engaged but no response received

Mode of Engagement	Stakeholder	Date
Emails (multiple)	KMA	24-Sept-2021 28-Sept-2021 06-Sept-2021 14-Oct-2021

Mode of Engagement	Stakeholder	Date
Emails, call and letter	Ministry of Defence – Coast Guard	17-Sept-2021 21-Sept-2021 – call 14-Oct-2021
Emails and letter	Water Resources Authority	17-Sept-2021
Emails and letter	Department of Environment, Waste Management and Energy	14-Oct-2021 21-Oct-2021
Emails and letter	Department of Finance and Economic Planning	14-Oct-2021 21-Oct-2021
Emails and letter	Department of Transport, Infrastructure and Public works *subsequently, a meeting was held on 26 January 2022	14-Oct-2021 22-Oct-2021
Emails and letter	Department of Trade, Tourism and Investments	14-Oct-2021 22-Oct-2021
Emails and letter	Department of Lands, Planning and Housing *subsequently, a meeting was held on 6 January 2022	14-Oct-2021 21-Oct-2021
Emails and letter	Department of Agriculture, Fisheries, Livestock and Cooperatives	14-Oct-2021 22-Oct-2021
Letter	Members of County Assembly for wards within Nyali and Shanzu Constituencies	28-Oct-2021
Letter	Ward Administrators	29-Oct-2021

Some of the stakeholders' offices, such as the State Department of ICT and Innovation in Mombasa, could not be physically located to deliver the letter.

Feedback from the second round of stakeholder engagement consultative

Eighteen meetings, both virtual and in person, were successfully conducted in this round of engagements. Two of these meetings were public meetings, one each with the Nyali and Shanzu communities. A sample of the public notice is included in Attachment 1.

Table 5 summarizes the comments raised by key informant stakeholders and the corresponding responses given by the consultant during the second round of engagements.

Table 5: Summary of feedback from second round of engagements

Ref	Institution/ Organisation/Entity	Landing Site	Date	Type	Comments and Queries from Stakeholder	Topic Addressed in this EIA
1	State Department of Fisheries, Aquaculture and The Blue Economy	Both	21-Sep-21	Virtual	• What are the exact Project timelines in 2022, with reference to the month that may affect fishing operations? • Characterize the sea bottom anticipated during the survey of the seabed for the cable location in terms of turbidity (sea grass and intertidal zone). Is the turbidity mitigation being put in shallow ground? • The timelines of installation should take into account the effect of noise on whales and other marine mammal that migrate in the water; mitigation for these effects should be implemented. • Fishing operations in the area need to be taken into account, both in shallow and deep water, and where fishing operations are particularly intense. • The fisheries development act stipulates that, for any Project with advance impact on marine habitat or fish grounds, a Fisheries Assessment Report must be done in tandem with the EIA studies for the DG to issue a letter of no objection for the project. The EIA Report has to be clear on mitigation for any marine habitats likely to be impacted by the Project. The Project developers are required to make an application to the DG in writing so that he can request a Fisheries Assessment report from NEMA, which should be part of the EIA report.	• The Project schedule and notifications are addressed in Sections 4.3.4 and 4.3.7. • Potential effects on marine species are addressed in Section 11. • The Project will coordinate and engage with the BMU and fisheries department, who will be given updates and notices. Information on fishing operations, landing sites and other related information has been requested from the State Department of Fisheries. Section 9.3.4 addresses fishing activity. • The Project team will coordinate with representative on this aspect.

Ref	Institution/ Organisation/Entity	Landing Site	Date	Type	Comments and Queries from Stakeholder	Topic Addressed in this EIA
2	KMFRI	Both	29-Sep-21	Virtual	• There was an inquiry regarding how the cables would be laid around the coral reef areas close to the shore and whether the cables would pass through the conservation areas. • Based on the map shared by the Project team, an active BMU is present in Pirates Beach, Nyali Beach, Mombasa and Shanzu, and the Project team should organize consultations with the BMU. • One of the KMFRI representatives asked whether it was possible to reroute the cables so they can avoid the corals and sea grass ecosystems. • The KMFRI team explained that dolphins around the area come from Tanzanian deep waters, but are mostly seen in the South Coast area. • The KMFRI team mentioned that there is a landing site in Nyali and that the Project team should countercheck with the fishermen on the ground to confirm the exact site.	• A marine survey was conducted to identify seafloor features to refine the cable route. In Mombasa North, the cables would pass through marine park and the Project team was in the process of engaging KWS to provide further assessment studies. Section 11 discusses marine resources and potential effects on sensitive resources along the cable route. • Preliminary engagements have been conducted with the BMU members in Shanzu and Nyali. Preparations have been made to engage the BMU in this phase, and to hold public meetings with beach users in the community. This Annex describes engagements conducted by the Project. • The cable routing process is described in Section 4.3, Technical Description of the Project.
3	KPA	Both	30-Sep-21	Virtual	• Fibre crossing – There was a problem with one of the cables previously installed in the area. The cable had not been properly secured to the bottom of the seabed and the cables got tangled between the ferry propellers. • KPA has two ports, one of them a big port for bigger ships. The areas need to be safe for ships to enter 'business as usual.' The Project should not impact this.	• The cable will be buried where feasible from a water depth of 0 m to <1,000 m to avoid interfering with marine users. • KWS have been informed about the Project and will undertake an ecological assessment of the cable route. • The BMH will be buried to a depth of 2 m below surface and the cover be flush with ground level, similar to utility manholes. It will not interfere with beach uses. • Notifications are described in Section 4.3.7.

Ref	Institution/ Organisation/Entity	Landing Site	Date	Type	Comments and Queries from Stakeholder	Topic Addressed in this EIA
					• Are there water marks to let people working around the area know that the installations have taken place? • Is KWS aware of the Project? • Will the entire BMH be visible? Will it affect users at the area? • The representative explained that on the ship schedule, KPA will need a month's notice to communicate with other ship users during the installation period.	
4	Department of National Administration – Assistant CC (Nyali)	Mombasa South	05-Oct-21	In-person	• The Project should be sure to notify the marine police, as well as the coast guard. • What buffer room is there for the cable? • What measures are going to be put in place to protect the local community from health issues such as sexually transmitted diseases from foreign teams coming into the area? There have been issues in the past on this matter.	• Notifications are described in Section 4.7. • The outlined buffer room is 200 m from the beach shoreline. • The installation team will be present in the Project area for a short duration. The Project duration will be 25 to 30 days for the laying and BMH construction. The Alcatel Submarine Networks (ASN) team sign a code of conduct that should be followed by all staff. An ASN representative will also be present during the installation phase to address any concerns that may arise.
5	Department of National Administration – Deputy Country Commissioner – (Shanzu)	Mombasa North	05-Oct-21	In-person	• The DCC advised that the Project team implementing the cable installation should work with local authorities to inform them of the Project progress at each phase. • The DCC mentioned that the hotels in the area will be very particular about the land restoration after the installation, given the beach access for their guests. • He suggested that ensuring that the right titles and deeds were in place was very important in the event that it would impact on	• The Project schedule and notifications are addressed in Sections 4.3.4 and 4.3.7. • Site restoration and additional best management practices incorporated in the Project are described in Section 4.3.7. • Land use and ownership in the Project area is described in Section 4. • The cable is high voltage, however it is heavily insulated, protected and is made of inert materials that will not corrode or release

Ref	Institution/ Organisation/Entity	Landing Site	Date	Type	Comments and Queries from Stakeholder	Topic Addressed in this EIA
					private land, and that proper due diligence should ensure they are correct and that they are not being scammed. • The DCC asked about the levels of radiation from the cable, and whether this might impact the health of local community members. • The DCC emphasized that the security of the equipment of the ASN cable laying team should be flagged. Protection may need to be considered again. For security, the marine police and coast guard should be made aware of the Project.	chemicals into the water or sand that would impact humans or animals. The temperature and magnetic field are negligible, and have not been linked to health impacts in the past on other ASN projects/cables. See Section 11.5.1.2 for further discussion. • The Project will engage with local authorities for information about planned activities at the beach areas near the Project.
6	Mombasa Land's Registry	Both	05-Oct-21	In-person	• The land registry representative advised the team to engage: ○ National Land Commission (NLC), in particular the regional office – as they deal with public land ○ Surveyors – they can assess the area and advise what land the Project is on. • The representative mentioned that the Lands registry office deals with private land. • The representative also explained that Security is under the authority of the CC's office; they should be made aware of the Project, in particular during implementation.	• The Project has communicated with the CC's office about the Project.

Ref	Institution/ Organisation/Entity	Landing Site	Date	Type	Comments and Queries from Stakeholder	Topic Addressed in this EIA
7	Mombasa County Commissioner	Both	05-Oct-21	In-person	Out of office at the time of the courtesy visit.	• A project description was shared with the secretary, who suggested that a letter be written to the CC to outline what support the Project would need from the CC's office.
8	NLC	Both	05-Oct-21	In-person/ Virtual	Out of office at the time of the courtesy visit. An NLC official was, however, consulted via telephone. The official advised the Project team to reach out to the CEO of NLC because any instruction should come from NLC HQ.	
9	KFS	Both	19-Oct-21	Virtual	Mr. Soi explained that the only concern for KFS would be if the cable route passes along mangrove sites. In this case, the Project implementation team would need to apply for a special user's licence through the Chief Conservator—eco systems conservator Mombasa and the Head of Conservancy Coast Region. He also explained that they would need to see the EIA Report once it has been submitted to NEMA. In the event that mangroves are affected, the implementation team would need to: • rehabilitate per square metre; • pay a special user licence fee; • pay a restoration fee; and • pay for the mangrove area used by the cable.	Section 9.2 describes natural resources in the Project area. There are no mangroves near either of the beach landing sites.

Ref	Institution/ Organisation/Entity	Landing Site	Date	Type	Comments and Queries from Stakeholder	Topic Addressed in this EIA
					The licensing process takes about 1 to 2 months however if the Project is urgent an early entry to work can be processed by KFS. He also added that he can be facilitated in terms of fuel to visit the site to determine whether there are mangroves present on site. It would take 2 days from the receipt of the request to determine if there are mangroves.	
10	Hotel – PrideInn beach resort [Shanzu]	Mombasa North	07-Oct-21	In-person	The hotel would like at least one month's notice from the date of installation, so they are aware.	The Project schedule and notifications are addressed in Sections 4.3.4 and 4.3.7.
11	Hotel – Serena [Shanzu]	Mombasa North	07-Oct-21	In-person	• The representative consulted inquired how big the manhole would be. • The hotel was not concerned about the Project as long as the Project activities do not affect the operations of the business, especially the fine dining restaurant. For instance, noise should be kept to minimum levels to avoid affecting the hotel rooms that are near the proposed BMH site. • They prefer if work could be avoided at night because noise from the machines or workers would disturb guests who are sleeping (starting at 6 pm).	• The BMH will be 2 m in width and 3 m lengthwise. Additional description is provided in Section 4.7. • The Project schedule and notifications are addressed in Sections 4.3.4 and 4.3.7.
12	KWS	Both	02 Nov-21	Virtual	• The representative mentioned that he had been informed that a letter would be written to the DG but he was yet to receive a copy of the letter. He asked about the exact locations of the beach manhole. • He further inquired whether the cables would be laid on top of coral or seabed grass.	• The Project has been coordinating with KWS. • Section 4.3.7 describes cable installation and protective measures. Section 11 addresses potential impacts to marine resources.

Ref	Institution/ Organisation/Entity	Landing Site	Date	Type	Comments and Queries from Stakeholder	Topic Addressed in this EIA
					• He added that it would be good for the Project team to involve the KWS staff in sensitive areas they have identified in the marine and the park.	
13	CA	Both	03-Nov-21	Virtual	• What formal engagement has taken place with CA so far, and has it been brought to their attention? • Who is landing the cable in Kenya?	• A Project representative from Meta (formerly Facebook) explained that CA was first made aware of the Project in a May 2020 (formal correspondence) engagement with the DG. Meta (then Facebook) had a session with the DG and some members of her team, providing them an update on the Project. In January 2021, a session with the licensing unit was undertaken. • The Project team is described in Section 3.4.

Comprehensive Questionnaire Survey Summary

A baseline survey was undertaken after the public meetings, a baseline survey was undertaken with sampled to collect the opinions and views of community members from both Nyali and Shanzu communities to collect opinions and views regarding:

1. environmental concerns such as effects on marine habitats, air, water quality and noise;
2. social and economic impacts; and
3. general concerns/suggestions.

From the analysis of the responses in the questionnaires, there is a general consensus among the participants that the environmental concerns and socioeconomic impacts of the project are minimal and can be adequately mitigated through the measures discussed in the meetings.

A copy of the sample questionnaire used in collecting the responses from the stakeholders is attached. (Attachment 2).

Attachment 1 – Sample Notice

PUBLIC MEETING ANNOUNCEMENT Issued: 23rd September, 2021

PROPOSED 2AFRICA SUBSEA CABLE PROJECT

PUBLIC BARAZA NOTICE!

The proposed 2Africa Project is a submarine cable project that will greatly enhance connectivity across Africa and the Middle East. At 37,000 kilometers (km) in length, 2Africa will be one of the world's largest subsea cable and will interconnect Europe, the Middle East, and 21 landings in 16 countries in Africa. The system will have two landings in Kenya, both located in Mombasa.

The marine components of the proposed project will be in Kenya's Exclusive Economic Zone (EEZ) and territorial sea. The terrestrial components of the proposed project will be at:

- **Mombasa North** located on Shanzu beach near the PrideInn Paradise Beach Resort and the Serena Beach Hotel and Spa [coordinates 03° 58.4610'S, 039° 45.0438'E]; and
- **Mombasa South** - located on Nyali beach near the Freedom Church Mombasa and the Nyali International Beach Hotel & Spa [coordinates 04° 03.0100'S, 039° 42.4150'E].

The Environmental Law in Kenya require that such a project undergoes an Environmental & Social Impact Assessment (ESIA) prior to development. The ESIA process entails public participation that ensures all stakeholders have been involved. Public participation is also an opportunity for the stakeholders to raise their concerns, provide suggestions and questions regarding the proposed project. A meeting has been scheduled to facilitate this interaction with the stakeholders of Nyali beach Area.

Date: **Wednesday 6th October, 2021**

Time: **9.00am**

Venue: **Khadija Primary School Social Hall**

Your opinion matters to us!

Please contact us if you have any questions or concerns regarding the proposed project.

Contact Person: Loise Kioko

Tel No.: 0719335653

Email Address: Lkioko@norken.co.ke

THANK YOU.

AECOM airtel Norken International Ltd ENGINEERING AND MANAGEMENT CONSULTANTS

PUBLIC MEETING ANNOUNCEMENT 23rd September, 2021

PROPOSED 2AFRICA SUBSEA CABLE PROJECT

PUBLIC BARAZA NOTICE!

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The Environmental Law in Kenya require that such a project undergoes an Environmental & Social Impact Assessment (ESIA) prior to development. The ESIA process entails public participation that ensures all stakeholders have been involved. Public participation is also an opportunity for the stakeholders to raise their concerns, provide suggestions and questions regarding the proposed project. A meeting has been scheduled to facilitate this interaction with the stakeholders of Shanzu Beach Area.

Date: **Thursday 7th October, 2021**

Time: **10.00am**

Venue: **Shanzu Chief's Office Compound**

Your opinion matters to us!

Please contact us if you have any questions or concerns regarding the proposed project.

Contact Person Loise Kioko

Tel No.: 0719335653

Email Address: Lkioko@norken.co.ke

THANK YOU.

AECOM airtel Norken International Ltd ENGINEERING AND MANAGEMENT CONSULTANTS

Attachment 2 – Sample Questionnaire

PUBLIC CONSULTATION AND PARTICIPATION FORM

Environmental Impact Assessment For the Proposed 2Africa Submarine Cable Project at Shanzu Beach in Mombasa County (Coordinates: 3˚58'.461'S, 39˚45.044' E)

The proposed 2Africa Submarine cable project will involve the installation of a fiber optic telecommunication cable around the African continent in 16 countries. One of the branching cables will land in Kenya at two sites in Mombasa. The marine components of the proposed project will be in Kenya's Exclusive Economic Zone (EEZ) and territorial sea while the terrestrial components of the proposed project will be at:

- **Mombasa North** located on Shanzu beach near the PrideInn Paradise Beach Resort and the Serena Beach Hotel and Spa [coordinates 3˚58'.461'S, 39˚45.044' E]; and
- **Mombasa South** - located on Nyali beach near the Freedom Church Mombasa and the Nyali International Beach Hotel & Spa [coordinates 04˚03.010'S,039˚42.415'E].

The fiber optic cable system will provide capacity necessary for the increasing amount of international communications traffic driven by the growing number of home and business broadband users. The 2Africa cable system will span approximately 37,000 km interconnecting Europe to the Middle East and Africa.

Norken International Limited, a NEMA Registered Firm of Experts, (NEMA Reg. No. 0181) is carrying out public participation for the proposed project as part of the Environmental Impact Assessment process as stipulated in the environmental laws in Kenya. Consultations are held with the members of the immediate community; and the interested/project affected people, in order to obtain their views regarding the proposed project.

This document outlines the list of questions that will be posed to relevant stakeholders interviewed to gather feedback and concerns of the project, that will be incorporated in the Environmental Impact Assessment (EIA) report.

Interview Guide:

Please provide your feedback into the questions below in order to complete the statutory requirements under the amended Environmental Management and Coordination Act (EMCA), 2015.

Name of respondent	
Name of Organization/Position/Relationship to project site	
Tel No.	
ID NO.	
E-mail	

We kindly request you to provide us with your opinion in terms of the positive and /or negative impacts that you think the proposed project will have on the environment, social and economic factors.

1. Environmental Concerns

Do you think the project will negative impacts on? a) Marine plants and animals? If yes, explain how.

b) Air and water quality?

c) Noise?

d) What other negative environmental impacts not listed above can the proposed project cause?

e) Please propose ways that the negative environmental impacts can be mitigated.

f) What positive environmental impacts can the proposed project cause?

2. Social and Economic Impacts:

a) What negative social and economic impacts do you think the proposed project may cause?

Social:

Economic:

Please suggest ways in which the negative impacts suggested in 2a above can be mitigated.

b) What positive social and economic benefits do you think the proposed project may cause?

Social:

Economic:

3. General Concerns/ Suggestions

a) What other issues of concern do you have regarding the proposed project? Propose ways in which this can be prevented or minimized.

b) Do you have any other comments or suggestions for the proposed project?

Signature:

Name: ……

Signature: …….....

Email: ……

Date…….……

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