# ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

# FULL STUDY REPORT (FSR)

# FOR

## THE PROPOSED INTEGRATED LAND & LAKE-BASED AQUACULTURE SYSTEMS AT TABLA BEACH ON L.R. NO: KASGUNGA/KAMRERI/6545, NYAMANGA SUB LOCATION, SUBA NORTH SUB-COUNTY, HOMABAY COUNTY, KENYA


| Prepared For | Prepared By |
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**Submitted To:**

National Environment Management Authority (NEMA) In accordance with EMCA Cap 387 and Environmental (Impact Assessment and Audit) Regulations, 2003

**Location GPS Coordinates**

| Point | Latitude | Longitude |
|---|---|---|
| Point A | -0.46233° S | 34.17825° E |
| Point B | -0.46790° S | 34.17080° E |
| Point C | -0.45905° S | 34.16517° E |
| Point D | -0.45243° S | 34.17437° E |

**June 2026**

## Certification

**Lakers Consultancy Limited** hereby submits the following Environmental and Social Impact Assessment (ESIA) for the proposed establishment of an Integrated Land-Based and Lake-Based Aquaculture Systems at Tabla Beach, Nyamanga sub location, Suba North Sub-County, Homa Bay County, Kenya. The proposed development combines pond-based (land) aquaculture with cage culture systems in Lake Victoria to enhance sustainable fish production in the region.

We the undersigned hereby certify that the information provided herein is accurate, and truthful to the best of our knowledge and belief.

Firm Of Experts:

**Lakers Consultancy Limited**
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NEMA Reg No: **NEMA/ENVIS/ELi/F0046**

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Proponent:

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On behalf of (Company/Hope Agritech).

**Name:** Hu Yun Wen **Designation:** Director

**Signed:** _____ **Date/Stamp:** HOPE AGRITECH LIMITED 04 JUL 2026 P.O. Box 21826-00505, NAIROBI

## Non-Technical Summary

The aquaculture and fisheries sector are key pillars of Kenya's Blue Economy, prioritized under the Fourth Medium Term Plan (MTP IV) 2023–2027 of Vision 2030 for its high potential to drive inclusive economic growth, food security, poverty reduction, employment creation, and wealth development. The sector directly employs over 500,000 people and indirectly supports more than two million, while blue resources overall provide food, employment, and incomes to over 1.2 million Kenyans. Kenya's aquaculture potential stands at 1.14 million hectares of suitable land, complemented by 14,681 km² of lakes, rivers and dams, 9,700 km² of territorial waters, and 142,400 km² of Exclusive Economic Zone (EEZ), offering a capacity to produce over 11 million metric tonnes (MT) of fish annually. In 2024, the total fish production was 168,424 Metric Tonnes (MT) worth 39.6 billion Kenya shillings amounting to a 4.4 percent increase in production compared to 161,307 MT worth 35.9 billion Kenya shillings landed in 2023.

Inland capture fisheries contributed 121,357 MT (Ksh. 26 billion), marine capture 39,950 MT (Ksh. 9.9 billion), and aquaculture 31,767 MT (Ksh. 10.0 billion). Freshwater aquaculture, which accounts for nearly 98% of national aquaculture output, is dominated by Nile Tilapia (*Oreochromis niloticus*), African Catfish (*Clarias gariepinus*), Common Carp (*Cyprinus carpio*), and Rainbow Trout (*Oncorhynchus mykiss*). Fish farming (aquaculture) recorded a 5 per cent increase in production of 33,423 MT of fish harvested in the year 2024 compared to 31,767 MT in 2023. *Kenya Fisheries Service National Aquaculture Development Plan and Strategy 2025*. Lake Victoria's Fishery accounted for 67,575 MT valued at 10.8 billion 1.99% decrease in catch compared to 70,313 MT recorded in the year 2023. The decrease was attributed to increasing overfishing and illegal fishing practices.

The sector has witnessed rapid expansion in various systems, with earthen ponds being the most common; Western region leads with 20,642 ponds, followed by Central (12,762) and Nyanza (10,578), while emerging technologies such as Recirculating Aquaculture Systems (RAS), aquaponics, and cage culture are gaining traction. However, national fish demand has risen to approximately 700,000 MT against a production of around 150,000–160,000 MT, driven by population growth and increased recognition of fish as a nutritious and economically viable protein source. Key challenges include inadequate supply of high-quality fish seed and limited availability of efficient, cost-effective feeds for different production stages, prompting Government efforts through the Kenya Bureau of Standards (KEBS) to establish fish feed quality standards.

It's against this backdrop that, Hope Agritech Limited herein referred as the proponent proposes to establish an Integrated Land and Lake-Based Aquaculture System at Tabla Beach, Lake Victoria, in Nyamanga sub-location, Gembe West location, Suba North Sub-County, Homabay County. This development is aligned with national priorities for sustainable aquaculture expansion and will be implemented in full compliance with the Environmental Management and Coordination Act (EMCA) Cap 387 and the Environmental (Impact Assessment and Audit) Regulations, 2003.

- **Project Objectives**

The main objective of the proposed Integrated Land and Lake-Based Aquaculture Project at Tabla Beach, Gembe West location, Suba North Sub-County, Homabay County, is to establish a commercially viable, environmentally sustainable, and socially responsible aquaculture enterprise that contributes to Kenya's Blue Economy and national food security goals. Key specific goals include but not limited to:

a) To increase fish production through the establishment of an integrated aquaculture system combining land-based ponds and lake-based cages,
b) To enhance food and nutritional security by increasing the local and regional supply of affordable, high-protein fish,
c) To create employment opportunities and improve livelihoods, with priority given to youth, women, and local communities in Suba North Sub-County, and
d) To promote sustainable aquaculture practices by adopting modern, climate-smart technologies that minimize environmental impacts on Lake Victoria.

- **Proposed Project Locations**

The proposed project site is located offshore within Lake Victoria, adjacent to Tabla Beach in Nyamanga sub location, Gembe West location, Suba North Sub-County, Homabay County, Kenya. Other project

components shall be land based on L.R. No: Kasgunga/Kamreri/6545. The site is geographically referenced using the World Geodetic System 1984 (WGS 84) datum at the following coordinates:

| Point | Latitude | Longitude |
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- **Project Components**

The proposed Integrated Land-Based and Lake-Based Aquaculture Project by Hope Agritech Limited at Tabla Beach, Suba North Sub-County, Homabay County, is designed as a modern, integrated aquaculture enterprise combining land-based pond systems with lake-based cage culture. The project aims to produce high-quality Nile Tilapia (*Oreochromis niloticus*).

- **Overall Project Design**

The proposed project will adopt an integrated where land-based facilities (mainly for fingerling production and broodstock management "Pond") complement lake-based cage systems (for commercial grow-out). This integration optimizes resource use, reduces risk, and enhances overall productivity.

- **Land-Based Components**

***Aquaculture Ponds***

The land-based component of the project will consist primarily of aquaculture ponds designed for different production stages, including broodstock rearing, hatchery and nursery operations, as well as fish grow-out. These will comprise both earthen and lined ponds to ensure flexibility and optimal water quality management. The total pond area is planned to cover approximately 1 acre subject to confirmation during the detailed engineering design phase.

Individual ponds will vary in size, ranging from 500m² to 1000 m², with an average water depth of 1.0 to 1.5 meters. Water supply to the ponds will be sourced through a controlled intake system from Lake Victoria supported by appropriate pumping and filtration infrastructure. Overflow systems will be incorporated to maintain optimal water levels and facilitate water exchange while minimizing environmental discharge impacts. Other components will include ***Breed stock hatching ponds, fingerlings nursery*** amongst other support ancillaries.

***Lake-Based Components (Cage Culture)***

The lake-based component of the project will involve the installation of floating cage culture systems in the near-shore waters of Lake Victoria, adjacent to Nyachebe Beach. These cages will primarily be used for the grow-out phase of Nile Tilapia production. The locations of these cages are as shown in Figure 1 above.

***Fish Cages:*** The project will deploy floating cage systems with standard dimensions of either 10–50-meter diameter and 4-5meter depth. The cage count shall be between 150 to 200 cages with potential for expansion to 250 cages. The cages will be stocked at a density of 50 to 80 fingerlings per cubic meter, subject to continuous water quality monitoring. All cages will be securely moored using appropriate anchoring systems designed to withstand the wave and current conditions typical of Lake Victoria.

***Cage Support Platforms:*** To support daily operations, the project will include floating walkways and feeding platforms. These will facilitate feeding, monitoring, and harvesting activities. Net cleaning and maintenance facilities will also be provided to ensure proper cage hygiene and longevity.

***Public Participation Feedback***

The first public consultation meeting was held on **19th June 2026** at Tabla beach proposed project site. This was followed by the second meeting also held at the same venue. Both forums/Barazas were attended by the local administration area Chief and Tabla Beach Management Unit, and the larger Nyamanga sub location community members.

The deliberations provided a platform for open discussion on various aspects of the proposed development, including its potential social, economic, and environmental impacts on the surrounding communities. Key topics explored during these sessions included anticipated project benefits, concerns regarding possible disruptions, and opportunities for corporate social responsibility (CSR) initiatives aimed at enhancing local welfare. Community members actively engaged by raising questions and sharing their perspectives about the proposed development. For a comprehensive overview of the public engagement, including detailed minutes of the meeting and responses from structured questionnaires, please refer to the annexure of this report.

***Summary of Impacts***

The proposed integrated aquaculture project at Tabla Beach on Lake Victoria involves fish farming using floating cages in the lake and land-based ponds, a hatchery, and supporting facilities like an ice plant. The project aims to produce fish, create jobs, and support local economic growth.

***Positive Impacts***

- Job Creation and Economic Benefits: The project will create employment during construction and long-term jobs during operation for local people. It will also support local businesses through the purchase of materials, food, transport, and other services.
- Food Security: Increased production of fish (mainly Nile tilapia) will improve the supply of affordable, high-quality protein for local communities and the wider region.
- Skills Development: Local residents will gain new skills in fish farming, which can benefit other aquaculture activities in the area.
- Reduced Pressure on Wild Fish: By farming fish, the project may help reduce overfishing pressure on Lake Victoria's natural fish stocks.

***Construction Phase Impacts (Temporary)***

a) Disturbance of lakebed and shoreline from installing cages and building ponds.
b) Increased dust, noise, and soil erosion.
c) Generation of waste and risk of water pollution from construction activities.
d) Temporary disruption to local fishing and community access.

***Operational Phase Impacts (Ongoing)***

a) Risk of water pollution from fish waste, uneaten feed, and chemicals.
b) Potential spread of fish diseases.
c) Risk of fish escaping from cages and mixing with wild fish.
d) Possible conflicts with local fishermen over lake space and resources.
e) Risk of habitat disturbance under the cages

- **Conclusion**

The proposed integrated aquaculture project at Tabla Beach, Suba North Sub-County, Homabay County, involving both lake-based cage culture and land-based ponds, hatchery, and supporting facilities (including an ice processing plant), is expected to deliver significant socio-economic benefits to the local community and contribute to Kenya's national goals of food security, employment creation, and blue economy development.

Key positive impacts of the proposed project shall include but not limited to:

a) Creation of direct and indirect employment opportunities during construction and operation phases;
b) Increased fish production to meet local and regional demand for high-quality protein;
c) Stimulation of local economic activities through supply chains, services, and market linkages;
d) Transfer of aquaculture skills and technology to local communities; and
e) Potential for improved livelihoods and reduced pressure on wild fish stocks in Lake Victoria.

The environmental and social impact assessment (ESIA) has identified several potential negative impacts, particularly related to water quality, lakebed disturbance, waste management, habitat alteration, fish disease risks, user conflicts, and climate change vulnerabilities. However, with the implementation of the

comprehensive mitigation measures outlined in this ESMP (*Sections 7.1 to 7.6*), these impacts can be effectively avoided, minimized, or adequately compensated.

The project is therefore considered environmentally and socially acceptable provided that all recommended mitigation measures, monitoring programs, and management plans are fully implemented. The risks associated with construction, operation, and eventual decommissioning are manageable through good industry practices, strict regulatory compliance, and adaptive management. Climate change risks, while significant in the Lake Victoria Basin, can be addressed through proactive adaptation measures integrated into project design and operations. Overall, the project aligns with national policies including the Kenya Vision 2030, the Blue Economy Strategy, Sustainable Development Goals (SDGs 2, 8, 13, and 14), and relevant fisheries and environmental legislation as well as Homabay Aquaculture and Blue Economy Policy.

- **Recommendation**

The following recommendations are made to ensure sustainable development and operation of the proposed aquaculture project:

i. The Project Proponent should integrate the entire Environmental and Social Management Plan (including Construction, Operational, Decommissioning, and Climate Change Adaptation sections) into all project contracts and operational procedures.
ii. Allocate adequate financial resources for the implementation, monitoring, and auditing of the ESMP throughout the project lifecycle.
iii. The proponent should obtain all necessary licenses, permits, and approvals from NEMA, Kenya Fisheries Service (KeFS), County Government of Homabay, and other relevant authorities before commencing any works.
iv. Maintain continuous, transparent, and inclusive engagement with local communities, Beach Management Units (BMUs), fishers, and other resource users.
v. Implement a robust monitoring program with clearly defined indicators, frequencies, and responsibilities as detailed in the ESMP tables.

It is highly recommended that the proposed aquaculture project at Tabla Beach be approved subject to strict adherence to the mitigation measures, monitoring requirements, and management plans presented in this ESIA/ESMP report. With effective implementation, the project will provide substantial socio-economic benefits while maintaining the ecological integrity of Lake Victoria and the well-being of local communities.

The successful delivery of this project will serve as a model for sustainable commercial aquaculture development in the Lake Victoria Basin, contributing to Kenya's blue economy agenda and long-term food security.

**Abbreviation and Acronyms**

| | |
|---|---|
| **BMU** | Beach Management Unit |
| **BOQ** | Bill of Quantity |
| **CEC** | County Executive Committee |
| **CIDP** | County Integrated Development Plan |
| **CPP** | Consultation and Public Participation |
| **DITTO** | Same as Above |
| **DOSH** | Directorate of Occupational Safety and Health |
| **DVS** | Directorate of Veterinary Services |
| **EA** | Environmental Audit |
| **EAC** | East Africa Community |
| **EHS** | Environment, Occupational Health and Safety |
| **EIA** | Environmental Impact Assessment |
| **EIA/EA** | Environmental Impact Assessment/Environmental Audit Regulations, 2003 |
| **EMCA** | Environmental Management and Coordination Act, 1999 |
| **EMP** | Environmental Management Plan |
| **EMS** | Environmental Management System |
| **ERP** | Emergency Response Plans |
| **ESIA** | Environmental and Social Impact Assessment |
| **ESMP** | Environmental and Social Management Plan |
| **GIS** | Geographic Information System |
| **GMOs** | Genetically Modified Organisms |
| **GPS** | Global Positioning System |
| **GRM** | Grievance Redress Mechanism |
| **HDPE** | High Density Polyethylene |
| **IAP** | Interested and Affected Parties |
| **ILRI** | International Livestock Research Institute |
| **ISO** | International Standards Organizations |
| **IWRM** | Integrated Water Resource Management |
| **KeFS** | Kenya Fisheries Services |
| **KMA** | Kenya Maritime Authority |
| **KPLC** | Kenya Power and Lighting Company |
| **LR** | Land Registration |
| **LVFO** | Lake Victoria Fisheries Organization |
| **NEAP** | National Environmental Action Plan |

| | |
|---|---|
| **NEC** | National Environment Council |
| **NEMA** | National Environment Management Authority |
| **NET** | National Environmental Tribunal |
| **NETF** | National Environmental Trust Fund |
| **PAPs** | Project Affected Persons |
| **PPE** | Personal Protective Equipment |
| **PSP** | Private Sector Participation |
| **TOR** | Terms of Reference |
| **SDF&BE** | State Department of Fisheries & Blue Economy |
| **SDGs** | Sustainable Development Goals |
| **SOPs** | Standard Operation Procedures |
| **SEM** | Sustainable Environmental Management |
| **VF** | Victory Farms Limited |
| **WRA** | Water Resources Authority |

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# 1. INTRODUCTION

## 1.1. Industry overview

The aquaculture and fisheries sector are key pillars of Kenya's Blue Economy, prioritized under the Fourth Medium Term Plan (MTP IV) 2023–2027 of Vision 2030 for its high potential to drive inclusive economic growth, food security, poverty reduction, employment creation, and wealth development. The sector directly employs over 500,000 people and indirectly supports more than two million, while blue resources overall provide food, employment, and incomes to over 1.2 million Kenyans. Kenya's aquaculture potential stands at 1.14 million hectares of suitable land, complemented by 14,681 km² of lakes, rivers and dams, 9,700 km² of territorial waters, and 142,400 km² of Exclusive Economic Zone (EEZ), offering a capacity to produce over 11 million metric tonnes (MT) of fish annually. In 2024, the total fish production was 168,424 Metric Tonnes (MT) worth 39.6 billion Kenya shillings amounting to a 4.4 percent increase in production compared to 161,307 MT worth 35.9 billion Kenya shillings landed in 2023.

Inland capture fisheries contributed 121,357 MT (Ksh. 26 billion), marine capture 39,950 MT (Ksh. 9.9 billion), and aquaculture 31,767 MT (Ksh. 10.0 billion). Freshwater aquaculture, which accounts for nearly 98% of national aquaculture output, is dominated by Nile Tilapia (*Oreochromis niloticus*), African Catfish (*Clarias gariepinus*), Common Carp (*Cyprinus carpio*), and Rainbow Trout (*Oncorhynchus mykiss*). Fish farming (aquaculture) recorded a 5 per cent increase in production of 33,423 MT of fish harvested in the year 2024 compared to 31,767 MT in 2023. *Kenya Fisheries Service National Aquaculture Development Plan and Strategy 2025*. Lake Victoria's Fishery accounted for 67,575 MT valued at 10.8 billion 1.99% decrease in catch compared to 70,313 MT recorded in the year 2023. The decrease was attributed to increasing overfishing and illegal fishing practices.

The sector has witnessed rapid expansion in various systems, with earthen ponds being the most common; Western region leads with 20,642 ponds, followed by Central (12,762) and Nyanza (10,578), while emerging technologies such as Recirculating Aquaculture Systems (RAS), aquaponics, and cage culture are gaining traction. However, national fish demand has risen to approximately 700,000 MT against a production of around 150,000–160,000 MT, driven by population growth and increased recognition of fish as a nutritious and economically viable protein source. Key challenges include inadequate supply of high-quality fish seed and limited availability of efficient, cost-effective feeds for different production stages, prompting Government efforts through the Kenya Bureau of Standards (KEBS) to establish fish feed quality standards.

It's against this backdrop that, **Hope Agritech Limited** herein referred as the proponent proposes to establish an Integrated Land and Lake-Based Aquaculture System at Tabla Beach, Lake Victoria, in Nyamanga sub-location, Gembe West location, Suba North Sub-County, Homabay County. This development is aligned with national priorities for sustainable aquaculture expansion and will be implemented in full compliance with the Environmental Management and Coordination Act (EMCA) Cap 387 and the Environmental (Impact Assessment and Audit) Regulations, 2003.

## 1.2. Proponent Profile

*Hope Agritech Limited* is a Kenyan-registered company specializing in sustainable agriculture and aquaculture development. Incorporated in Kenya under the Companies Act, 2015, the company is duly registered and licensed to carry out aquaculture operations, including land-based and lake-based fish farming activities.

Hope Agritech Limited was established with a vision to contribute to Kenya's food security, economic growth, and the Blue Economy by promoting modern, environmentally sustainable, and commercially viable aquaculture practices. The company is headquartered in Nairobi Kenya with sub regional offices in Homa-Bay County.

### 1.3. Project Objectives

The main objective of the proposed Integrated Land and Lake-Based Aquaculture Project at Tabla Beach, Gembe West location, Suba North Sub-County, Homabay County, is to establish a commercially viable, environmentally sustainable, and socially responsible aquaculture enterprise that contributes to Kenya's Blue Economy and national food security goals. Key specific goals include but not limited to:

e) To increase fish production through the establishment of an integrated aquaculture system combining land-based ponds and lake-based cages,
f) To enhance food and nutritional security by increasing the local and regional supply of affordable, high-protein fish,
g) To create employment opportunities and improve livelihoods, with priority given to youth, women, and local communities in Suba North Sub-County, and
h) To promote sustainable aquaculture practices by adopting modern, climate-smart technologies that minimize environmental impacts on Lake Victoria.

### 1.4. Objectives and Scope of the ESIA Study

Under the EMCA, Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003. Under Legal Notice No. 31 and 32 of 2019, development projects in Kenya are categorized into three classes: **Low**, **Medium**, and **High Risks**. Projects designated as high risk are those likely to result in significant adverse environmental and social impacts, thereby necessitating the preparation of an Environmental Impact Assessment (EIA) Full Study Report (FSR) under sub regulation 1 part VI of the regulations.

Given the scale and nature of the proposed development, the project falls within the High-Risk category (***Aquaculture systems exceeding one hectare***). Accordingly, the Proponent is obligated, through a Registered and Licensed NEMA Lead Expert, to submit ESIA report for review and approval by the National Environment Management Authority (NEMA). Therefore, the overall objective of the EIA study is to ensure that the proposed project is environmentally and socially sound, and that its implementation contributes to sustainable development. The study was conducted to identify, assess, and evaluate all potential environmental and social risks and impacts both positive and adverse arising from the proposed project.

The specific objectives of the assignment were but are not limited to:

a) Prepare a comprehensive Environmental and Social Impact Assessment (ESIA) in full compliance with the legal requirements stipulated under Section 58 of the EMCA, Cap 387, and Part VI of the Environmental Impact Assessment and Audit (EIA/EA) Regulations, 2003,
b) Assess the baseline conditions and potential impacts on geology, soils, water resources (including Lake Victoria water quality), air quality, and climate change resilience and adaptation,
c) Assess aquatic and terrestrial biodiversity, fish species composition and abundance, sensitive habitats, and the overall ecological health of the Lake Victoria ecosystem,
d) Assess socio-economic aspects including community livelihoods, public health, employment opportunities, gender dynamics, cultural heritage, and undertake comprehensive stakeholder engagement,
e) Predict and evaluate both positive and negative impacts (direct, indirect, cumulative, and residual) associated with the proposed project,
f) Assess social impacts and safety risks associated with the proposed project site and activities for both land-based and lake-based aquaculture systems, and
g) Develop a detailed Environmental and Social Management Plan (ESMP) outlining mitigation measures, monitoring programs, responsibilities, timelines, and budgets for the effective management of identified impacts throughout the project lifecycle.

### 1.5. Study Approach

The approach adopted in undertaking this ESIA study was integrated, multi-disciplinary, and participatory. The assessment combined both scientific and socio-economic methodologies as outlined in the table 1 below to ensure a comprehensive understanding of the baseline environmental and social conditions, as well as the potential impacts of the proposed land and lake-based aquaculture systems.

*Table 1: ESIA Methodology*

| Methodology | Narrative |
|---|---|
| **Desktop** | A thorough review of existing literature, relevant policies, legal and institutional frameworks, previous studies, scientific publications, and secondary data on the Lake Victoria basin. This included analysis of hydrological data, environmental reports, fisheries statistics, and socio-economic profiles of the project area. |
| **Pelagic and Limnological Assessment** | Detailed assessment of the open-water (pelagic) zone of Lake Victoria, focusing on water column characteristics, stratification patterns, nutrient dynamics, dissolved oxygen levels, and primary productivity. This was particularly critical for evaluating the suitability and potential impacts of lake-based aquaculture systems. |
| **Geospatial Analysis** | Utilization of remote sensing data, Geographic Information Systems (GIS), and satellite imagery to map land use/cover, sensitive ecosystems, bathymetry (for lake areas), soil types, drainage patterns, and potential project footprints. This helped in spatial impact prediction and site suitability analysis. |
| **Field Sampling and Laboratory Analysis** | Systematic field surveys and collection of primary data on physical, chemical, and biological parameters. This included:<br>• Surface sampling;<br>• Lake water quality profiling (physico-chemical and microbiological parameters);<br>• Aquatic biodiversity surveys (plankton, macroinvertebrates, and fish species);<br>• Terrestrial ecological surveys (flora and fauna);<br>• Air quality and noise measurements.<br>All samples were analyzed in accredited laboratories using standard methods to ensure data reliability and accuracy. |
| **Stakeholder Engagement and Socio-Economic Surveys** | Comprehensive consultation with key stakeholders, including local communities, fisherfolk, BMU, government agencies, NGOs, and other interested parties. This involved key informant interviews, focus group discussions, household questionnaires, and public meetings to capture community perceptions, livelihood patterns, and concerns. |

The entire study was guided by and conducted in full compliance with national regulatory requirements, particularly the Environmental (Impact Assessment and Audit) Regulations, 2003 (Legal Notice No. 150) and associated administrative procedures under the EMCA, Cap 387.

### 1.6. Justification

The demand for high-quality Tilapia in the Country and the broader Lake Victoria region remains strong and continues to rise. Kenya faces a significant national fish supply-demand gap, with annual production hovering around 160,000–170,000 metric tonnes against an estimated demand of over 500,000 metric tonnes. Per capita fish consumption stands at approximately 2.5–4.5kg per year, well below the World

Health Organization recommendation of 10.4 kg. In response to this growing deficit, the project proponent proposes the development of an Integrated Land-Based and Lake-Based Aquaculture System at Tabla Beach, Nyamanga sub location, Gembe West location, Suba North Sub-County, Homabay County. The project will focus on sustainable Tilapia production to increase local fish supply, strengthen food and nutritional security, and generate substantial employment opportunities for the local population. The farm will incorporate eco-friendly designs, including advanced waste management, effluent treatment, and recycling systems, to ensure minimal environmental impact while maintaining high productivity. This sustainable approach aligns with best practices in Lake Victoria aquaculture and addresses common challenges such as pollution and ecosystem health.

The proposed development will contribute meaningfully to Kenya's Vision 2030, the country's development blueprint, which emphasizes food security, poverty reduction, and sustainable economic growth through agricultural transformation and the Blue Economy. By boosting local Tilapia production, the project will help bridge the national fish supply gap and support county-level efforts to modernize fisheries and aquaculture, as outlined in Homabay County's Fisheries and Aquaculture Development Policy.

### 1.7. Project Cost

The total estimated investment cost for the proposed project is USD. 1,000,000 (One Million Dollars). The project cost covers the development of both land-based ponds/tanks and lake-based cage culture systems, along with supporting infrastructure for sustainable operations. A detailed cost breakdown is provided as annexure.

## 2. PROJECT DESCRIPTION

### 2.1. Proposed Project Locations

The proposed project site is located offshore within Lake Victoria, adjacent to Tabla Beach in Nyamanga sub location, Gembe West location, Suba North Sub-County, Homabay County, Kenya. Other project components shall be land based on L.R. No: Kasgunga/Kamreri/6545. The site is geographically referenced using the World Geodetic System 1984 (WGS 84) datum at the following coordinates:

| Point | Latitude | Longitude |
|---|---|---|
| Point A | -0.46233° S | 34.17825° E |
| Point B | -0.46790° S | 34.17080° E |
| Point C | -0.45905° S | 34.16517° E |
| Point D | -0.45243° S | 34.17437° E |


*Figure 1: Google Map Location*

### 2.2. Project Components

The proposed Integrated Land-Based and Lake-Based Aquaculture Project by Hope Agritech Limited at Tabla Beach, Suba North Sub-County, Homabay County, is designed as a modern, integrated aquaculture enterprise combining land-based pond systems with lake-based cage culture. The project aims to produce high-quality Nile Tilapia (*Oreochromis niloticus*).

### 2.3. Overall Project Design

The proposed project will adopt an integrated where land-based facilities (mainly for fingerling production and broodstock management "Pond") complement lake-based cage systems (for commercial grow-out). This integration optimizes resource use, reduces risk, and enhances overall productivity.

### 2.3.1. Land-Based Components

#### 2.3.1.1. Aquaculture Ponds

The land-based component of the project will consist primarily of aquaculture ponds designed for different production stages, including broodstock rearing, hatchery and nursery operations, as well as fish grow-out. These will comprise both earthen and lined ponds to ensure flexibility and optimal water quality management. The total pond area is planned to cover approximately 1 acre subject to confirmation during the detailed engineering design phase.

Individual ponds will vary in size, ranging from 500m² to 1000 m², with an average water depth of 1.0 to 1.5 meters. Water supply to the ponds will be sourced through a controlled intake system from Lake Victoria supported by appropriate pumping and filtration infrastructure. Overflow systems will be incorporated to maintain optimal water levels and facilitate water exchange while minimizing environmental discharge impacts. Other components will include ***Breed stock hatching ponds, fingerlings nursery*** amongst other support ancillaries.

*Plate 1: Typical Pond Culture and Hatchery*

#### 2.3.1.2. Lake-Based Components (Cage Culture)

The lake-based component of the project will involve the installation of floating cage culture systems in the near-shore waters of Lake Victoria, adjacent to Nyachebe Beach. These cages will primarily be used for the grow-out phase of Nile Tilapia production. The locations of these cages are as shown in Figure 1 above.

***Fish Cages:*** The project will deploy floating cage systems with standard dimensions of either 10–50-meter diameter and 4-5meter depth. The cage count shall be 100 cages stocked at a density of 50 to 80 fingerlings per cubic meter, subject to continuous water quality monitoring. All cages will be securely moored using appropriate anchoring systems designed to withstand the wave and current conditions typical of Lake Victoria.

***Cage Support Platforms:*** To support daily operations, the project will include floating walkways and feeding platforms. These will facilitate feeding, monitoring, and harvesting activities. Net cleaning and maintenance facilities will also be provided to ensure proper cage hygiene and longevity.

*Plate 2: Typical Cage System*

### 2.3.2. Support Infrastructure

The project will include essential support infrastructure to ensure efficient and smooth operations. This will comprise an ***administrative block*** for on-site management, ***demonstration centre***, ***hatchery lab***, ***net warehouse***. A dedicated ***feed storage*** and processing unit, equipped with silo storage facilities, will be constructed to securely store and handle commercial fish feeds.

A harvesting and primary processing area will be established, complete with ***ice processing plant***, ***and cold storage rooms*** to maintain fish quality after harvest. Additionally, a pump house and water supply system, incorporating filtration and aeration equipment, will be installed to provide reliable and good-quality water to the ponds. Internal access roads and pathways will be developed to facilitate movement within the project site, while a wastewater treatment system, including treatment ponds and an effluent management system, will be put in place to handle and treat wastewater from the facility in an environmentally responsible manner.

### 2.3.3. Ancillary Components

The project will incorporate several ancillary components essential for efficient, safe, and environmentally sustainable operations.

- **Security** Adequate security measures will be implemented, including perimeter fencing around the land-based facilities and 24-hour security presence for both the terrestrial and lake-based installations to safeguard project assets and personnel.
- **Waste Management System:** A comprehensive waste management system will be established, featuring solid waste collection points, effluent treatment facilities, and sludge management infrastructure. These measures are designed to minimise environmental pollution, particularly the protection of Lake Victoria's water quality.

**Environmental Monitoring Stations:** Dedicated environmental monitoring stations and equipment will be installed to enable regular assessment of key parameters such as water quality, dissolved oxygen levels, and fish health.

This will support proactive management and ensure compliance with environmental standards throughout the project lifecycle.

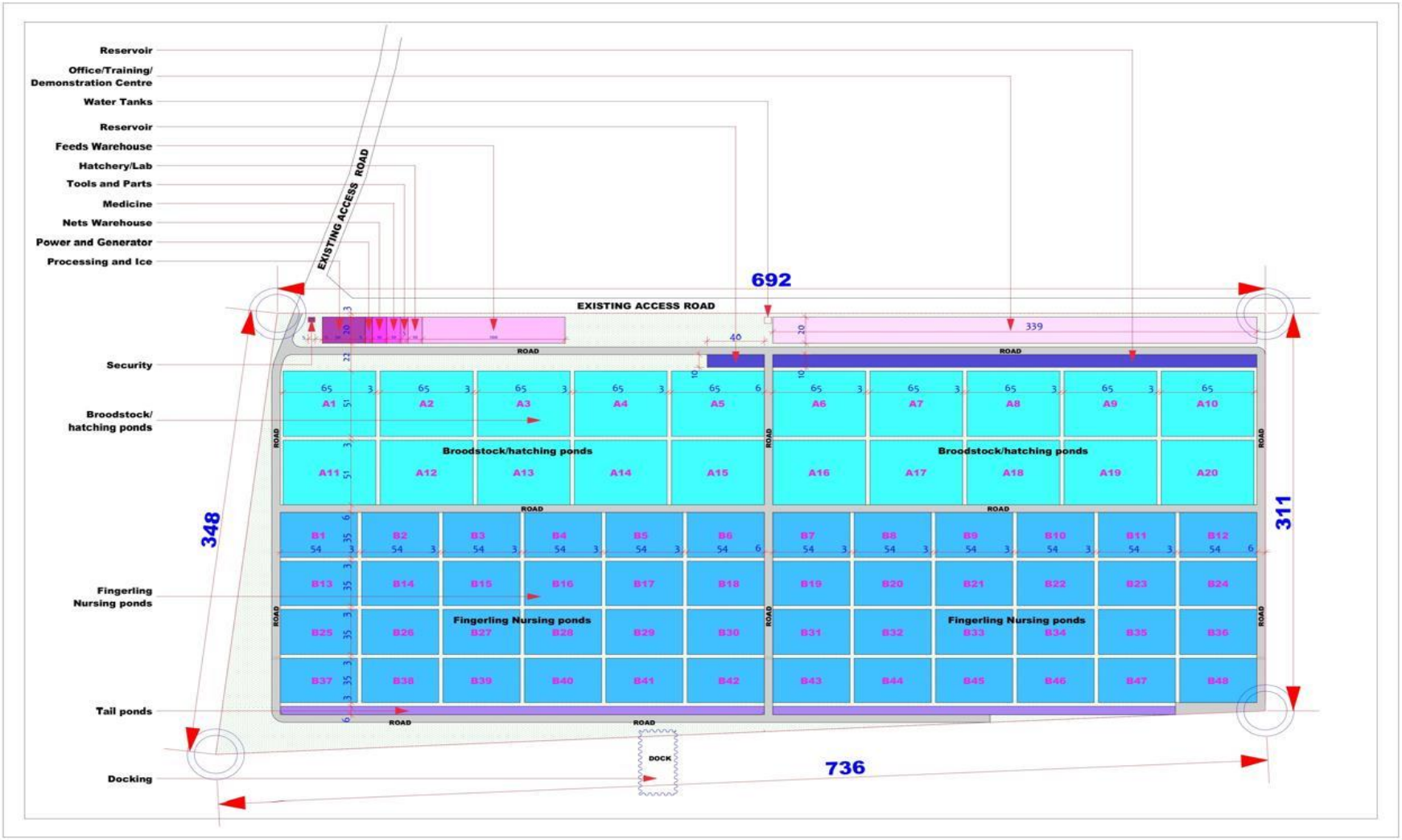


*Figure 2: Site Layout*

## 3. RELEVANT POLICY, LEGISLATIVE & PLANNING FRAMEWORKS

Several national and county policies, strategies, and legal provisions have a direct bearing on the planning, implementation, and sustainable operation of the proposed Integrated Land-Based and Lake-Based Aquaculture System at Tabla Beach, Gembe West location, Suba North Sub-County, Homabay County. These frameworks will provide strategic direction, regulatory guidance, and support for sustainable aquaculture development, environmental protection, water resource management, and socio-economic benefits. The key instruments reviewed are as outlined below.

### 3.1. Constitution of Kenya 2010

As the supreme law of the land, the Constitution of Kenya 2010 provides the foundational legal framework for all development activities in the country. It is often referred to as the "Green Constitution" due to its strong emphasis on environmental protection and sustainable development. Key relevant provisions include:

- **Article 42**, which guarantees every person the right to a clean and healthy environment, including the right to have the environment protected for the benefit of present and future generations through legislative and other measures.
- **Article 69**, which outlines the State's obligations in respect of the environment, including ensuring sustainable exploitation, utilization, management and conservation of the environment and natural resources; achieving and maintaining at least 10% tree cover; and encouraging public participation in environmental management.
- **Article 70**, which provides for the enforcement of environmental rights, allowing any person to seek redress in court for violation of environmental rights. Other supporting provisions in Chapter Five (Land and Environment) and various articles on public participation, benefit-sharing, and equitable access to resources.

**Relevance**: The proposed project will be developed in full conformity with the Constitution of Kenya 2010. The ESIA process upholds the constitutional right to a clean and healthy environment by comprehensively assessing and mitigating potential impacts on Lake Victoria's ecosystem, water quality, biodiversity, and surrounding communities.

### 3.2. National Aquaculture Development Plan & Strategy (2025)

This strategy outlines a comprehensive roadmap for the growth of Kenya's aquaculture sector, with a vision for "globally competitive, ecologically sound aquaculture for sustainable socio-economic development." It identifies priority areas including enabling environment creation, innovation, research, marketing, and climate-smart practices. **Relevance:** The project directly supports the Plan's objectives by promoting sustainable land-based and cage culture systems, technology adoption, and responsible resource use in Lake Victoria, thereby contributing to increased production and bridging the national fish supply gap

### 3.3. National Aquaculture Value Chain Development Strategy (2024–2028)

This strategy provides a focused framework for transforming Kenya's aquaculture sector by strengthening the entire value chain from quality inputs (such as certified fingerlings and nutritionally balanced feeds) through efficient production, post-harvest handling, processing, value addition, marketing, and distribution to final consumption. It seeks to increase the sector's contribution to national GDP (currently around 0.6%), create more jobs, reduce post-harvest losses, improve food and nutritional security, and enhance the competitiveness of Kenyan aquaculture products both locally and regionally. The Strategy emphasizes public-private partnerships, technology adoption, climate resilience, and sustainable practices to address key bottlenecks in the industry. **Relevance**: The proposed Integrated Land and Lake-Based Aquaculture System at Tabla beach directly supports the objectives of this Strategy. Through efficient Tilapia production using modern, eco-friendly technologies, the project will contribute to higher productivity and output.

### 3.4. National Blue Economy Strategy (2025–2030)

This Strategy was launched in February 2026 and provides a comprehensive framework for harnessing Kenya's ocean, lake, and river resources to drive sustainable economic growth. It is organized around nine thematic areas, with Strategic Focus on Sustainable Fisheries, Aquaculture & Aquatic Ecosystems as a core pillar. The Strategy aims to significantly scale up the Blue Economy's contribution to GDP (targeting an increase from approximately Ksh 40 billion to Ksh 350 billion annually by 2030), triple fish production from the current 163,000 metric tonnes to over 450,000 metric tonnes through expanded aquaculture, create millions of direct and indirect employment opportunities, and promote responsible resource use, climate resilience, and environmental sustainability. It emphasizes integrated approaches that balance economic development with ecosystem conservation, community inclusion, and innovation.

**Relevance**: The proposed project is strongly aligned with strategic focus one of the Strategy by reducing pressure on wild fish stocks, enhancing food and nutritional security, generating local employment (especially for youth and women), building climate resilience, and advancing Kenya's broader Blue Economy ambitions in inland freshwater systems.

### 3.5. Kenya Vision 2030

Vision 2030 is Kenya's long-term national development blueprint, launched in 2008 and running through to 2030, envisions transforming Kenya into "a newly industrializing, middle-income country providing a high quality of life to all its citizens by the year 2030." The Vision is anchored on three pillars; Economic, Social, and Political and is supported by foundational factors including infrastructure, science, technology, and innovation. Under the Economic Pillar, it prioritizes agriculture and fisheries transformation, food security, and the Blue Economy. The Social Pillar emphasizes improved livelihoods, health, nutrition, and poverty reduction, while the Political Pillar focuses on good governance and equity. Aquaculture and sustainable fisheries are highlighted as key drivers for agricultural modernization and Blue Economy growth.

**Relevance**: The proposed Integrated Land and Lake-Based Aquaculture System at Tabla Beach, Suba North Sub-County will directly contribute to the realization of Kenya Vision 2030. By increasing high-quality Tilapia production, the project will help bridge the national fish supply-demand gap, enhance food and nutritional security, and support poverty reduction through employment creation and income generation for local communities.

### 3.6. Kenya Fisheries Policy (2023)

This Policy provides strategic direction for the sustainable management, conservation, and development of Kenya's fisheries and aquaculture resources. It seeks to achieve key national objectives including food and nutritional security, employment creation, wealth generation, and poverty alleviation while ensuring environmental sustainability. The Policy builds directly on the Fisheries Management and Development Act, 2016, particularly Part VIII which addresses aquaculture development, licensing requirements, environmental standards, site suitability assessments, and sustainable production practices. It promotes the shift from capture fisheries to responsible aquaculture, value addition, climate resilience, and improved governance of the sector.

**Relevance**: The proposed Integrated Land-Based and Lake-Based Aquaculture System at Tabla Beach directly operationalizes the Kenya Fisheries Policy (2023). By introducing modern, sustainable Tilapia production systems (both pond/tank-based and cage culture), the project will help reduce pressure on overexploited wild fish stocks in Lake Victoria while increasing overall fish supply.

### 3.7. Homabay County Fisheries and Aquaculture Development Policy (2025)

This county-specific policy, developed through broad stakeholder consultation and launched in November 2025, provides a comprehensive framework for modernizing the fisheries and aquaculture sub-sector in Homabay County. It aims to harness the county's vast aquatic resources which constitute approximately 55%

of Kenya's portion of Lake Victoria while addressing critical challenges such as declining wild fish stocks, low aquaculture productivity, high post-harvest losses, limited access to quality inputs (seed and feed), and inadequate infrastructure. The Policy adopts a gender-sensitive and inclusive approach, emphasizing investment promotion, sustainable resource management, climate resilience, value chain development, and decent employment creation. Its vision is "A vibrant, modern, commercialized, and sustainably managed county fisheries and aquaculture sub-sector."

**Relevance**: The proposed Integrated Land and Lake-Based Aquaculture System is strategically located within Homabay County and is fully aligned with this Policy.

### 3.8. National Environmental Policy (2014) (Sessional Paper No. 10 of 2014)

This is the Kenya's overarching policy framework for environmental management and sustainable development. It provides broad principles and guidelines for integrating environmental considerations into all public and private sector development programmes, projects, and activities. Key pillars of the Policy include pollution prevention and control, conservation and sustainable management of natural resources, protection of biodiversity and ecosystems, climate change adaptation and mitigation, environmental governance, and public participation. It strongly advocates for the use of EIA as a key tool for ensuring that development projects are environmentally sound and socially acceptable.

**Relevance**: *The ESIA process for the proposed Integrated Land-Based and Lake-Based Aquaculture System at Tabla beach is fully guided by and compliant with the National Environmental Policy (2014).*

### 3.9. National Water Policy (2021)

This Policy provides the overarching framework for the management, development, and sustainable use of water resources in Kenya. It promotes Integrated Water Resources Management (IWRM), equitable access to water, pollution prevention, conservation of water bodies, and climate change adaptation in the water sector. The Policy recognizes the critical role of water in food security, economic development, and ecosystem health, while emphasizing stakeholder participation, decentralization of water governance, and protection of water catchments and riparian zones. It also addresses challenges such as water pollution, over-abstraction, and the impacts of climate change on water resources.

**Relevance**: *The proposed project will rely heavily on Lake Victoria as its primary water source. The project will fully comply with the National Water Policy (2021) by ensuring sustainable water abstraction, responsible effluent management, and the implementation of robust wastewater treatment and recycling systems.*

### 3.10. Relevant Legal and Statutory Frameworks

#### 3.10.1. Environmental Management and Coordination Act (EMCA), Cap 387

This is the principal legislation governing environmental management and conservation in Kenya. Enacted in 1999 and revised in 2015, EMCA provides for the establishment of an integrated framework for the sustainable management of the environment and natural resources. It institutionalizes environmental governance through the NEMA and establishes key tools such as EIA, Strategic Environmental Assessment (SEA), Environmental Audits, and Environmental Management Plans.

Key provisions relevant to the project include:

- Section 58, which mandates that any new project or activity likely to have a significant adverse environmental impact must undergo a full EIA study before implementation.
- Part VI of the Environmental (Impact Assessment and Audit) Regulations, 2003 (Legal Notice No. 150), which provides detailed procedures for conducting EIA studies, stakeholder engagement and public participation, preparation of Environmental and Social Management Plans (ESMPs), project approval processes, and post-approval monitoring and auditing.

**Relevance:** The full ESIA study for the proposed aquaculture project was undertaken in strict compliance with EMCA Cap 387 and the 2003 EIA/EA Regulations. The Act guided the identification, assessment, and mitigation of potential impacts on Lake Victoria's water quality, biodiversity, soils, air quality, and surrounding communities, while ensuring sustainable waste management and ecosystem protection.

### 3.10.2. Regulations under the Environmental Management and Coordination Act, Cap 387

The table 2 below summarizes the key subsidiary regulations under EMCA that are directly relevant to the proposed Integrated Land-Based and Lake-Based Aquaculture System. These regulations provide specific standards, licensing requirements, and compliance obligations for environmental protection for any proposed project.

*Table 2: Relevant EMCA Regulatory Provisions*

| Regulation | Legal Notice | Key Objectives / Provisions | Relevance to the Project |
|---|---|---|---|
| **Environmental (Impact Assessment and Audit) Regulations** | Legal Notice No. 101 of 2003 (as amended) | EIA for all projects listed in the Second Schedule legal notice 150, which includes activities likely to have significant environmental impacts such as large-scale aquaculture projects, cage culture in lakes, water abstraction from water bodies, and land reclamation or development along lake shores. | The full ESIA for this aquaculture project is prepared in strict compliance with these Regulations. |
| **Environmental Management and Coordination (Water Quality) Regulations** | Legal Notice No. 177 of 2024 | Prevent pollution of water resources and set standards for water used for domestic, industrial, agricultural, fisheries, and recreational purposes.<br>Regulate wastewater/effluent discharge, require effluent discharge licenses, monitoring, and compliance with prescribed limits.<br>Promote protection of water bodies (including lakes) and buffer zones. | Critical for the project's use of Lake Victoria water. It governs sustainable water abstraction, effluent treatment from aquaculture operations, wastewater recycling, and discharge to prevent pollution of the lake ecosystem. |
| **Environmental Management and Coordination (Waste Management) Regulations** | Legal Notice No. 178 of 2024 | Provide a comprehensive framework for handling, segregation, storage, transportation, treatment, and disposal of all categories of waste (solid, hazardous, biomedical, etc.).<br>Promote waste minimization, recycling, circular economy principles, and the "polluter pays" principle.<br>Require licensing for waste transporters, treatment facilities, and disposal sites. | Directly applicable to solid waste, sludge, and effluent from fish farming, processing, and hatchery activities.<br>The project will implement waste recycling and treatment systems to comply with these regulations. |
| **Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations** | Legal Notice No. 160 of 2006 | Provide for the conservation and sustainable use of biological diversity.<br>Regulate access to genetic resources and benefit-sharing<br>Protect endangered species, habitats, and ecosystems. | Relevant to the protection of aquatic and terrestrial biodiversity in Lake Victoria and surrounding areas. The project must avoid adverse impacts on fish species, sensitive habitats, and the overall lake ecosystem. |

| Regulation | Legal Notice | Key Objectives / Provisions | Relevance to the Project |
|---|---|---|---|
| **Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations** | Legal Notice No. 61 of 2009 | Control noise and excessive vibration from construction, machinery, vehicles, and operational activities.<br>Prescribe permissible noise levels for different zones (e.g., residential, industrial, silent zones).<br>Require permits for noisy activities and mitigation measures. | Applies during construction (e.g., earthworks, piling, equipment installation) and operation (aerators, generators, boats).<br>The project will implement noise control measures to protect workers, local communities, and wildlife. |

### 3.10.3. Fisheries Management and Development Act, No. 35 of 2016

This is the primary legislation governing the management, development, utilization, and conservation of fisheries and aquaculture resources in Kenya. The Act repeals the earlier Fisheries Act (Cap 378) and aligns the sector with the Constitution of Kenya 2010, Vision 2030, and sustainable development principles. It establishes institutions such as the Kenya Fisheries Services (KeFS) and provides for the regulation of both capture fisheries and aquaculture.

Part VIII of the Act is specifically dedicated to Aquaculture Development. It covers critical areas including:

- Aquaculture licensing and permitting requirements;
- Site selection and approval criteria;
- Environmental standards and impact assessment for aquaculture projects;
- Standards for cage culture, pond systems, and recirculating aquaculture systems (RAS);
- Monitoring, control, and surveillance of aquaculture operations;
- Disease control, biosecurity, and quarantine measures;
- Water use and effluent management in aquaculture; and
- Promotion of sustainable and responsible aquaculture practices.

**Relevance**: The proposed Integrated Land-Based and Lake-Based Aquaculture System will require an Aquaculture License and site approval under Part VIII of the Fisheries Management and Development Act, 2016. The proposed project will operationalize the Act by introducing modern, environmentally responsible Tilapia farming practices that ease pressure on overexploited wild fish stocks in Lake Victoria.

### 3.10.4. The Water Act, 2016

This Act provides a comprehensive legal framework for the management, conservation, protection, and equitable utilization of water resources in Kenya. It aligns with the Constitution of Kenya 2010 by recognizing water as a public resource and a basic human right. The Act establishes key institutions, including the Water Resources Authority (WRA) as the lead national regulator responsible for issuing permits for water abstraction, water use, and effluent discharge. It also provides for the formation of Water Resource Users Associations (WRUAs) to facilitate community participation in water resource management at the local level.

Key provisions include:

- Classification and protection of water resources (surface and groundwater);
- Regulation of water abstraction through permit systems;
- Control of wastewater and effluent discharge into water bodies;
- Promotion of Integrated Water Resources Management (IWRM);
- Establishment of water quality standards and pollution prevention measures;
- Catchment-level planning and climate change adaptation in water management.

**Relevance**: The proposed Aquaculture System will heavily depend on Lake Victoria for water supply in both pond/tank systems and cage culture operations. Compliance with the Water Act 2016 is therefore essential. The project will require a Water Abstraction Permit from the Water Resources Authority (WRA) for any water drawn from the lake. Additionally, all wastewater and effluent generated from aquaculture activities (including uneaten feed, fish waste, and processing residues) must meet stringent effluent discharge standards and require a Waste Discharge Permit.

### 3.10.5. Occupational Safety and Health Act (OSHA), 2007

This is the principal legislation in Kenya governing the safety, health, and welfare of workers and all persons at workplaces. The Act applies to all sectors, including aquaculture and fisheries operations. It imposes

general and specific duties on employers, employees, and other duty holders to ensure safe and healthy working conditions. It is enforced by the Directorate of Occupational Safety and Health Services (DOSHS).

The Act contains several key relevant provisions. Section 6 outlines the general duties of employers to ensure the safety, health, and welfare of all persons at the workplace, including the provision and maintenance of safe systems of work, safe plant and machinery, and a safe working environment. Section 9 requires the registration of workplaces with DOSHS. Section 15 places a duty on employers to conduct risk assessments and implement necessary preventive and protective measures. Section 19 provides for the establishment of Safety and Health Committees at workplaces with more than 20 employees. Section 22 requires the provision of information, instruction, training, and supervision to employees. Section 77 mandates the preparation and implementation of emergency preparedness and response plans. Part VIII (Sections 94–101) addresses occupational health, including medical examinations and the prevention of occupational diseases. Finally, Section 125 stipulates penalties and offences for non-compliance with the provisions of the Act.

**Relevance**: The proposed Aquaculture System at Tabla Beach will involve multiple occupational hazards such as working over water, operation of machinery, handling of chemicals, and fish processing. The ESIA has assessed these risks, and the project will fully comply with the Occupational Safety and Health Act, 2007.

#### 3.10.6. Public Health Act (Cap 242)

This is the principal legislation in Kenya addressing the prevention and control of diseases and the overall protection of public health. Enacted to safeguard human health, the Act empowers authorities to take necessary measures against health hazards arising from environmental pollution, poor sanitation, unsafe water, and other nuisances. It provides a broad framework for disease surveillance, prevention of outbreaks, food safety, waste management, and control of environmental conditions that may adversely affect public health.

Key provisions relevant to development projects include measures for the prevention of waterborne and vector-borne diseases, control of nuisances, regulation of waste disposal, protection of water sources, and enforcement of sanitation standards. The Act also grants powers to health officers to inspect premises and enforce compliance to safeguard community health.

**Relevance**: The proposed project has the potential to generate wastewater, solid waste, and effluent that could affect public health if not properly managed. The project will fully comply with the Public Health Act (Cap 242) by implementing robust measures to prevent waterborne diseases (such as cholera and typhoid), ensuring proper treatment and disposal of aquaculture waste, maintaining high standards of sanitation, and protecting surrounding communities and water users from potential health risks associated with lake-based operation.

#### 3.10.7. Community Land Act, 2016

This Act gives effect to Article 63 of the Constitution of Kenya 2010 by providing for the recognition, protection, registration, and management of community land. It defines community land as land lawfully held, managed, or used by specific communities as community forests, grazing areas, shrines, ancestral lands, and lands traditionally occupied by hunter-gatherer communities. The Act shifts from previous trust land systems to a more secure and participatory framework for community ownership and governance of land.

The Act establishes procedures for communities to register as legal entities, form Community Assemblies (comprising all adult members), elect Community Land Management Committees (7–15 members), and develop bylaws for land administration. It emphasizes equitable access and benefit-sharing, gender inclusion

(including automatic membership for spouses), protection against discrimination, and sustainable management of natural resources. It also outlines rules for land use planning, investment on community land, and compulsory acquisition (requiring free, prior, and informed consent, public purpose justification, and just compensation).

**Relevance:** The proposed Aquaculture System at Tabla Beach is located in an area where community land rights may apply, particularly along the Lake Victoria shoreline. The project will fully comply with the Community Land Act, 2016 by:

- Respecting and, where applicable, engaging registered community land management structures;
- Ensuring meaningful public participation and stakeholder consultation with local communities during project implementation.

### 3.10.8. Sustainable Waste Management Act, No. 17 of 2022

This is Kenya's primary legislation on sustainable waste management. It repealed and replaced the outdated Solid Waste Management Regulations and provides a modern, comprehensive framework for the management of all categories of waste (solid, liquid, hazardous, e-waste, etc.). The Act is guided by the principles of the circular economy, waste hierarchy (prevention, reduction, reuse, recycling, recovery, and disposal as the last resort), extended producer responsibility (EPR), and the "polluter pays" principle. Key provisions include:

- Promotion of sustainable solid waste management practices across the waste value chain;
- Segregation of waste at source;
- Licensing and regulation of waste handlers, transporters, recyclers, and disposal facilities;
- Establishment of county-level waste management plans;
- Incentives for waste recovery, recycling, and circular economy initiatives;
- Strict controls on illegal dumping and open burning;
- Integration of climate change and environmental considerations in waste management.

**Relevance:** The proposed Aquaculture System will generate significant quantities of solid waste, including uneaten fish feed, fish faeces/sludge, dead fish, packaging materials, and general domestic waste. The project will fully comply with the Sustainable Waste Management Act, 2022 by implementing a robust and sustainable solid waste management system.

### 3.10.9. Institutional Frameworks

The aquaculture sector in Kenya is governed through a multi-sectoral institutional framework involving national government ministries, state corporations, county governments, research institutions, and environmental regulatory agencies as outlined in the Table 3 below.

*Table 3: Relevant Institutions*

| Institution | Core Mandate | Relevance |
|---|---|---|
| **State Department for Fisheries, Aquaculture and the Blue Economy** | Coordinate the development of policies, legal, regulatory, and institutional frameworks for fisheries, aquaculture, and the Blue Economy. The Department is responsible for fisheries and aquaculture policy formulation, fisheries licensing policy, fish quality assurance, fisheries development, fisheries marketing policy, protection of aquatic ecosystems, promotion of Kenya as a Center for aquaculture, capacity | Provides policy direction for aquaculture investments, fish cage farming, fish seed production, value addition and market development. |

| Institution | Core Mandate | Relevance |
|---|---|---|
| | building, and coordination of research and innovation in the fisheries sector.<br><br>It also oversees key fisheries institutions including KeFS, KMFRI, KFMA, and KFIC. | |
| **Kenya Fisheries Service** | Established under the Fisheries Management and Development Act, 2016, KeFS is mandated to conserve, manage, develop, and regulate Kenya's fisheries and aquaculture resources. Its functions include licensing and registration of aquaculture enterprises, fisheries compliance and enforcement, fish health management, aquaculture development, fisheries monitoring, control and surveillance, promotion of sustainable fisheries utilization, and implementation of fisheries policies and regulations. | Issues aquaculture licenses, regulates cage farming activities in Lake Victoria, monitors fish health, fish movement, biosecurity and compliance with aquaculture regulations. (kefs.go.ke) |
| **Kenya Marine and Fisheries Research Institute** | KMFRI is the national research institution established under the Science, Technology and Innovation Act, 2013 with the mandate to conduct research in marine and freshwater fisheries, aquaculture, aquatic ecology, oceanography, limnology, biotechnology, and environmental conservation. The Institute generates scientific information to support sustainable management and development of fisheries and aquaculture resources in Kenya. | KMFRI provides scientific and technical support for aquaculture and fish cage farming in Lake Victoria. The Institute undertakes site suitability assessments, water quality monitoring, carrying capacity studies, fish health research, environmental monitoring, and development of improved aquaculture technologies. KMFRI also provides scientific recommendations on cage placement, stocking densities, feed management, and environmental safeguards to ensure sustainable cage farming operations. |
| **National Environment Management Authority** | NEMA is established under the EMCA, 1999 (Revised 2015) as the principal government agency responsible for the supervision, coordination, and implementation of environmental policies and environmental management in Kenya. NEMA reviews and approves EIA and Environmental Audit (EA) reports, monitors environmental compliance, and enforces environmental laws and regulations. | Reviews and approves EIA studies, monitors environmental compliance, waste management and ecosystem protection for fish cage projects. |
| **Water Resources Authority** | The Water Resources Authority (WRA) is established under the Water Act, 2016 and is mandated to regulate, protect, conserve, manage, and coordinate the use of Kenya's water resources. The Authority is responsible for planning, allocation, monitoring, protection of water catchments, issuance of water permits, and enforcement of water resource management regulations. | The authority will ensure sustainable utilization of lake and surface water resources and protect water quality in aquaculture production areas. |
| **Kenya Bureau of Standards** | KEBS is the national standards body established under the Standards Act (Cap. 496). Its mandate is to develop, promote, and enforce standards; provide conformity assessment services including testing, inspection, and certification; and ensure the quality and safety of products, processes, and services in Kenya. KEBS also facilitates consumer | The bureau will provide standards for fish feeds, fish products, processing facilities and quality assurance systems in aquaculture value chains. |

| Institution | Core Mandate | Relevance |
|---|---|---|
| | protection and enhances competitiveness of Kenyan products in local and international markets. | |
| **County Government of Homabay** | Established under the Constitution of Kenya, 2010 and the County Governments Act, 2012, the County Government of Homabay is responsible for county planning and development, implementation of devolved functions, provision of agricultural and fisheries extension services, environmental management, public health services, local infrastructure development, and promotion of economic growth within the county. Through the Department of Blue Economy, Fisheries, Mining and Digital Economy, the County Government promotes sustainable fisheries and aquaculture development. | The County Government plays a central role in facilitating aquaculture and fish cage farming development within Homabay County. It supports fish farmers through extension services, capacity building, stakeholder engagement, licensing and permitting processes, infrastructure development, and promotion of investment in the fisheries and aquaculture sector. The County Government also coordinates implementation of fisheries development programs and ensures that aquaculture projects align with county development priorities and land-use plans. |
| **Kenya Plant Health Inspectorate Service** | KEPHIS is a state corporation established under the Kenya Plant Health Inspectorate Service Act, 2012 with the mandate to assure the quality of agricultural inputs and produce, prevent the introduction and spread of pests and diseases, enforce phytosanitary measures, and regulate the importation and exportation of plants, plant products, and related materials. KEPHIS is also responsible for seed certification, plant variety protection, and agricultural biosecurity management. | KEPHIS will supports biosecurity measures for integrated aquaculture systems involving aquatic plants and feed ingredients. |
| **Beach Management Units** | Beach Management Units are community-based fisheries co-management organizations established under the Fisheries Management and Development Act, 2016 and related regulations.<br><br>BMUs bring together fishers, fish traders, boat owners, fish processors, and other stakeholders involved in fisheries activities. Their mandate is to promote sustainable management of fisheries resources, support compliance with fisheries regulations, enhance stakeholder participation in fisheries governance, and protect aquatic ecosystems at landing sites and fishing areas. | BMU will assist in identifying suitable cage farming areas, conflict resolution, surveillance, environmental stewardship and protection of fish breeding grounds around cage sites. |

# 4. ENVIRONMENTAL & SOCIO-ECONOMIC BASELINE INFORMATION

## 4.1. County Background

This Section describes the spatial project location, existing climate conditions, water and geological characteristics, biological, socio-economic environment, aesthetics and cultural resources and the general Homa-Bay County at large. The description provides the baseline against which the operation of the proposed Aquaculture system will be determined. Homabay County lies between latitudes 0°15' South and 0°52' South, and between longitudes 34°00' East and 35°00' East. The county spans a total area of approximately 4,267.1 km², of which 1,227 km² is covered by the waters of Lake Victoria, making it one of the counties with significant inland water resources in Kenya. Geographically, Homabay County is strategically positioned along the southern shores of Lake Victoria, and shares borders with several other counties and one international boundary. It borders Kisumu and Siaya Counties to the North, Kisii and Nyamira Counties to the East, Migori County to the South, and Lake Victoria and the Republic of Uganda to the West.

## 4.2. Physical Environment

### 4.2.1. Physical and Topographic Features

The county is divided into two main relief regions: the lakeshore lowlands and the upland plateau. The lakeshore lowlands, lying between 1,163 and 1,219 meters above sea level, form a narrow strip along the shores of Lake Victoria, particularly in the northern parts of the county. The upland plateau begins at approximately 1,219 meters above sea level and features an undulating landscape shaped by the erosion of an ancient plain. This region is marked by residual highlands, including the Gwassi and Ngorome Hills in Suba South, the Gembe and Ruri Hills in Suba North, the Wire Hills in Kasipul, and the Homa Hills in Karachuonyo.

Rusinga Island comprises several hills, the tallest being Lugongo Hill, which rises about 300 meters above lake level. Lake Victoria itself lies at an elevation of 1,134 meters above sea level. The hills are composed primarily of volcanic sediments and agglomerates dating back to the Early Miocene period. These geological deposits originate from a large volcano centered at Rangwa Hill on the mainland, which also produced the agglomeratic hills of Gwassi and Gembe, as well as deposits found on the Uyoma Peninsula in Central Nyanza. The proposed project area, Tabla beach, features a slightly undulating terrain that gently slopes toward the lakeshore.

*Figure 3: Landform Features (At the Background Kamasengere Hill)*

### 4.2.2. Climatic Conditions

The climatic conditions in the Lake Victoria region, including Mbita and Tabla areas, are significantly influenced by the lake's vast water mass, which acts as a climatic modifier. The presence of Lake Victoria creates a permanent low-pressure zone that contributes to increased convective activity and precipitation. This phenomenon results in substantial rainfall, particularly along the northern and western shores, where moist southerly and easterly trade winds converge and rise over the lake's surface (Kendal, 1969).

On the Kenyan shoreline, annual rainfall typically ranges from 800mm to 1,300mm, with precipitation levels increasing as one move northeastward toward the Kavirondo Gulf. The rainfall pattern is relatively well distributed throughout the year, characterized by bimodal peaks corresponding to the long rains (March–May) and short rains (October–December). The presence of the lake helps buffer extreme seasonal variability, reducing the occurrence of prolonged dry spells and supporting year-round moisture availability. Temperatures in the region remain consistently warm throughout the year, typically ranging between 18°C and 32°C, contributing to a humid, tropical climate. The average relative humidity is generally high due to persistent evaporation from the lake surface.

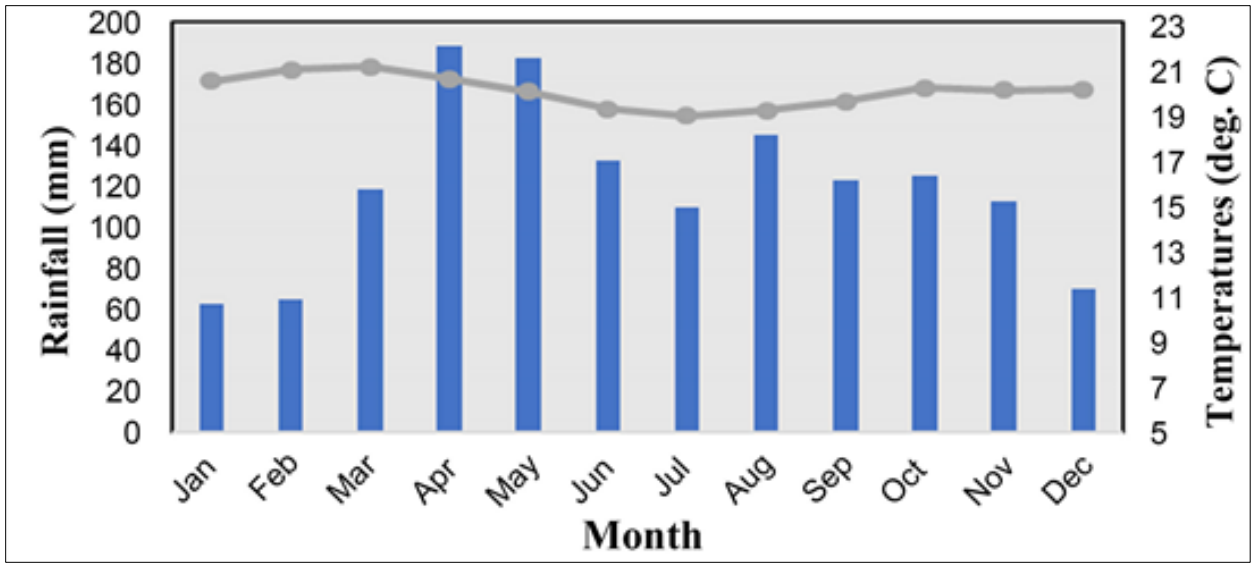


*Figure 4: Spatial and Temporal Characteristics of Rainfall over the Lake Victoria (Source: https://www.scirp.org/journal/paperinformation?paperid=99827)*

### 4.2.3. Geology and Soils

The geological formation of Mbita and Gwasi areas are located in the Nyanza region of Kenya, is primarily influenced by the broader Lake Victoria Basin and the Nyanza Craton, one of the oldest geological formations in East Africa. This region is characterized by Precambrian basement rocks, mainly composed of granites, gneisses, schists, and quartzites, which form the foundation of the area's geological structure. The rocks of the Gwasi area comprise Precambrian lavas and sediments belonging to two systems, an extensive series of volcanic and intrusive rocks as well as sediments of Tertiary age, and various sediments of Pleistocene and Recent age. During the Palaeozoic and Mesozoic eras stable continental conditions prevailed, and there is no evidence of sedimentation, volcanic activity, or of igneous intrusions.

The oldest rocks exposed in the area belong to the weakly metamorphosed Nyanzian System. Unlike the Basement System rocks long regarded as the oldest in Kenya the Nyanzian rocks have undergone only low-grade "phyllite" metamorphism. In the southern part of the county, these formations comprise metabasalts interbedded with banded ironstones and well-preserved pillow lavas; as well as greywackes, andesitic tuffs, and conglomerates that also feature banded ironstone layers. Tuffaceous and silty slates, along with andesites and additional banded ironstones, are also present. Further north, the rock sequence includes andesites with distinct pillow structures, andesitic tuffs, basalts, and potentially intrusive porphyritic andesites. In the southern part of the county, these formations comprise metabasalts interbedded with banded ironstones and well-preserved pillow lavas; as well as greywackes, andesitic tuffs, and conglomerates that also feature banded ironstone layers. Tuffaceous and silty slates, along with andesites and additional banded ironstones, are also present. Further north, the rock sequence includes andesites with distinct pillow structures, andesitic tuffs, basalts, and potentially intrusive porphyritic andesites. South of the Kanyamwa Fault, a wide belt of rhyolites and banded ironstones completes the geological succession.

### 4.2.4. Drainage (Surface Water)

The project area falls within the Lake Victoria drainage basin and is characterized by a relatively sparse surface drainage network due to the prevailing geological formations, topography, and climatic conditions. Surface water occurrence in the broader Homabay region, including Mbita, and Rusinga Island, and the surrounding areas, is largely seasonal, with most watercourses flowing only during and immediately after

rainfall events. The only notable perennial stream within the wider region is the Olando River, which originates from the Kanyada highlands and flows in a northeasterly direction before discharging into the Kavirondo Gulf of Lake Victoria, east of Homabay Town. This river serves as an important source of freshwater for local communities and ecosystems within its catchment area.

The Gwasi Massif, characterized by steep slopes and highly eroded terrain, contains numerous ephemeral drainage channels. These watercourses convey storm runoff for only a few hours following intense rainfall events before drying up. The rapid runoff is attributed to the steep topography, shallow soils, and limited water retention capacity of the landscape. To the north and east of the massif, surface streams disappear into the highly permeable alluvial deposits of Lambwe Valley, where infiltration rates are high and groundwater recharge is significant. A similar drainage pattern is observed on the Ruri Hills, where seasonal streams flow during periods of heavy rainfall but quickly lose discharge as water infiltrates into the underlying geological formations. Consequently, surface water availability in these areas is generally limited outside the rainy seasons.

In contrast, Mfangano Island exhibits relatively better-developed surface drainage characteristics. The island contains several short but permanent streams originating from the elevated central plateau. These streams flow gently downslope toward the surrounding lake shoreline, providing localized freshwater resources and supporting riparian vegetation and associated ecosystems. Rusinga Island, which is predominantly underlain by porous Lower Miocene sedimentary rocks, exhibits limited surface water retention. The high permeability of these geological formations facilitates rapid infiltration of rainfall, resulting in the development of short-lived streams that occur mainly as storm torrents following rainfall events. Consequently, most drainage channels on the island remain dry for extended periods and only become active during periods of intense precipitation. At the project site and its immediate environs, surface drainage is primarily influenced by direct runoff into Lake Victoria. During rainfall events, overland flow is generated and conveyed through natural drainage pathways toward the lake.

*Plate 3: Lake Victoria as Viewed from Tabla Beach*

#### 4.2.5. Water Quality

The Lake Victoria ecosystem has undergone substantial and, to some observers, alarming changes that have accelerated over the last three decades. Massive algal blooms have developed, becoming increasingly

dominated by the potentially toxic blue-green variety. The lake water transparency has declined from 5m in the early 1930s, to 1m or less for most of the year by the early 1990s. Waterborne diseases also have increased in frequency. Although presently under control, water hyacinth, absent in the lake as late as 1989, choked important waterways and landings, especially in bay areas in Kenya and Uganda, in the late 1990s. Over-fishing introduced fish species and oxygen depletion at lower lake depths threaten the artisanal fisheries and biodiversity (over 200 indigenous species are facing possible extinction). These extensive changes have been attributed both to the introduction of Nile perch that altered the food web structure, and to increased nutrient input to the lake, resulting in eutrophication. Land use has intensified and human and livestock population increased, especially along the lakeshore and on the islands in the lake. Increased pollution from municipal and industrial discharges.

The load of nutrients buried in the sediments was calculated using a mass balance approach, indicating that 20,100 t/y of phosphorus were buried in the sediments, and 502,900 t/y were released by the sediments into the water column. The same calculation approach resulted in a net deposition of 73,400 t/y of nitrogen in the sediments. Pollution of Lake Victoria from heavy metals and organics appears to be localized. For example, although copper (Cu), mercury (Hg), lead (Pb), cadmium (Cd), chromium (Cr) and zinc (Zn) were found in the sediments of Mbita Gulf, they were not present in dangerous concentrations.

## 4.3. Biological Environment

### 4.3.1. Biological Resources (Fauna and Flora)

Mbita and the surrounding areas along the Lake Victoria shoreline support a diverse range of plant communities, whose distribution is largely influenced by soil characteristics, topography, and drainage conditions. Along the lakeshore, the vegetation is characterized by scattered woodland dominated by trees reaching heights of up to 15 metres. Common species in this zone include *Balanites aegyptiaca, Acacia seyal, and Euphorbia candelabrum*, which are well adapted to the relatively dry conditions and shallow soils prevalent near the shoreline.

Moving inland and upslope, the vegetation composition changes considerably due to variations in physiography, particularly the presence of steep slopes and shallow rocky soils. These hillside communities are typically dominated by species such as *Acacia seyal, Sapium ellipticum, Commiphora spp.*, and *Rhus natalensis*. Trees in these areas are generally shorter, ranging from approximately 4 to 12 metres in height, reflecting the more challenging growing conditions. Areas that were previously cultivated or cleared and have since been left fallow are characterized by dense secondary vegetation. These regenerating communities consist mainly of scrubby thickets dominated by *Acacia, Tamarindus, and Euphorbia species*. The secondary vegetation plays an important ecological role by stabilizing soils, reducing erosion, and providing habitat for wildlife.

A distinct variation of the lakeshore vegetation community is the *Acacia drepanolobium* woodland associated with black cotton soils. While this type of vegetation is relatively uncommon on the islands, it occurs extensively across Lambwe Valley, where the terrain is predominantly flat and underlain by expansive clay soils. In the better-drained sections of the valley floor, the composition of tree thickets differs somewhat from that found on Rusinga Island, although *Acacia seyal* remains the dominant species in many locations. In general the vegetation of Mbita-Rusinga-Lambwe landscape reflects the interaction between soil conditions, topography, drainage characteristics, and historical land-use practices, resulting in a mosaic of lakeshore woodland, hillside thickets, secondary scrub vegetation, and valley-floor woodlands.

*Plate 4: Area Vegetation Cover (Acacia aegyptiaca)*

### 4.3.2. Aquatic Communities

Lake Victoria originally had a multi-species fishery, in which two tilapiine species (*Oreochromis Esculentus,* O. *Variabilis*) were the most important (Ogutu-Ohwayo 2003). In the mid-1950s, the lake had a diverse fish fauna, comprising 28 genera and about 350 species (Greenwood 1974) of these species, more than 300 were haplochromine cichlids (Greenwood 1974; Witte et al. 2000). Beginning in the 1950s, Nile perch (Lates niloticus) and non-indigenous tilapiines, Nile tilapia (*Oreochromis niloticus, O. leucostictus, Tilapia zilli, T. Rendalli*) were introduced into the lake.

Mbita Bay and the surrounding waters of Lake Victoria support a diverse aquatic ecosystem comprising fish, aquatic macrophytes, plankton, benthic organisms, and other aquatic fauna. The ecological characteristics of the bay are influenced by water depth, nutrient availability, seasonal fluctuations, shoreline habitat conditions, and human activities such as fishing, transport, settlement development, and aquaculture.

The aquatic vegetation in the area consists primarily of emergent, submerged, and floating macrophytes. Common species include papyrus (*Cyperus papyrus*), cattails (*Typha domingensis*), water lilies (*Nymphaea* spp.), and various submerged aquatic plants that provide breeding, nursery habitats, and feeding for fish and other aquatic organisms. In some sheltered bays and shoreline areas, invasive water hyacinth (*Eichhornia crassipes*) may occur, although its abundance varies over time depending on prevailing environmental conditions and management interventions.

The phytoplankton community is dominated by blue-green algae (*cyanobacteria*), diatoms, and green algae, which form the primary producers within the aquatic food web. Zooplankton, including *rotifers, cladocerans, and copepods*, are abundant in the water column and serve as an important food source for juvenile fish and other aquatic organisms. The fish community in Mbita Bay is diverse and includes both native and introduced species of commercial and ecological importance. Commonly occurring species include Nile tilapia (*Oreochromis niloticus*), Nile perch (*Lates niloticus*), silver cyprinid or dagaa (*Rastrineobola argentea*), African catfish (*Clarias gariepinus*), lungfish (*Protopterus aethiopicus*), and several haplochromine cichlid species. The

shallow nearshore waters, wetlands, and vegetated areas serve as important breeding and nursery grounds for many fish species.

*Plate 5: Nile tilapia (Oreochromis niloticus) Source: Kilimo News*

#### 4.3.3. Aquatic Weeds

Water hyacinth (*Eichhonia crassipes*) is an invasive aquatic macrophyte that invaded Lake Victoria in 1989, causing significant socio-economic and environmental impacts that remain largely unquantified (Ochiel and Wawire 2001, Raytheon et al. 2002). Water hyacinth has a high growth rate, resulting in physical obstruction of waterways, and water abstraction units, among others (*Masifwa et al. 2001*). It produces large quantities of long-lived seeds that can survive up to 30 years and weed populations can double every 5-15 days at temperatures between 25-27.5°C. The weed forms a permanent floating fringe, often replacing the obligate *acropleustophyte, Pistia stratiotes*, at the highly productive wetland/open water interface (Denny 1991), altering the food web. However, at the proposed site locations, there were no presence of water hyacinth noticed during the assessment.

#### 4.3.4. Terrestrial Mammals

The proposed project area and its immediate surroundings support limited terrestrial mammal (Wildlife) populations due to extensive human settlement, agricultural activities, livestock grazing, and other land-use practices that have significantly modified the natural habitat. Historical vegetation clearance and continued anthropogenic disturbances have reduced the availability of suitable habitats for many wild mammal species. During the site assessment, no wild terrestrial mammal species were observed within the proposed project area. The area is predominantly occupied by human settlements and small-scale farming activities, which have contributed to habitat fragmentation and displacement of wildlife. Consequently, the occurrence of large and medium-sized wild mammals within the project footprint is considered unlikely.

The only mammals observed during the field survey were domesticated animals, including cattle (*Bos taurus*), goats (*Capra hircus*), sheep (*Ovis aries*), dogs (*Canis familiaris*), and cats (*Felis catus*), which are commonly kept by local households for subsistence and economic purposes.

### 4.3.5. Avian Species (Bird Species)

The proposed project area and its surrounding environment support a variety of bird species commonly associated with human settlements, lakeshore habitats, and open grasslands. The proximity of the site to Lake Victoria provides suitable feeding, nesting, and resting habitats for both residents and migratory bird species. Birds play an important ecological role in the area through seed dispersal, pollination, pest control, and maintenance of ecosystem balance.

During the site assessment, several common bird species were observed. These included species typically associated with homesteads, and lakeshore environments. Commonly occurring birds in the wider Mbita and Homabay area include weavers *(Ploceus spp.*), pied crows (C*orvus albus*), cattle egrets (*Bubulcus ibis*), little egrets (*Egretta garzetta*), black kites (*Milvus migrans*), marabou storks (*Leptoptilos crumenifer*), kingfishers (*Alcedo spp. and Halcyon spp.*), doves (*Streptopelia spp.*), sunbirds (C*innyris spp.*), and various species of swallows and swifts. The shoreline areas of Lake Victoria and nearby wetlands provide important habitats for waterbirds such as herons, egrets, cormorants, African fish eagles (*Haliaeetus vocifer*), and other aquatic bird species.

*Plate 6: Bird Species Observed (Little egrets)*

## 4.4. Socio-Economic

### 4.4.1. Population Distribution

According to the 2019 Kenya Population and Housing Census (KPHC), Homabay County had a total population of 1,131,950 persons, comprising 539,560 males, 592,367 females, and 23 intersex persons. The county has experienced steady population growth over the years, driven by natural increase and the economic opportunities associated with fishing, agriculture, trade, and emerging aquaculture activities along the shores of Lake Victoria.

Population distribution within the county is influenced by access to natural resources, infrastructure, economic activities, and settlement patterns. The highest population concentrations are generally found along the Lake Victoria shoreline, in major urban centres such as Homabay Town, Mbita, and Oyugis, and in areas with productive agricultural land. Fishing and related economic activities have particularly attracted settlements along the lakeshore and on the islands. The islands and lakeshore areas within Kaksingiri and Gembe West locations are predominantly inhabited by the Suba community, whose ancestors are believed to have

migrated from Uganda several centuries ago. The Suba people maintain a distinct cultural identity, language, and traditional practices, although many have gradually integrated with neighbouring communities through social and economic interactions.

The majority of the county's population comprises the Luo community, who occupy most parts of the mainland and are traditionally engaged in fishing, crop farming, livestock keeping, and trade. Other ethnic groups represented within the county include small populations of Kisii, Kipsigis, Luhya, and other Kenyan communities who have migrated into the area for business, employment, and agricultural opportunities. The Kisii and Kipsigis communities are particularly found in parts of Gwasi and on Mfangano Island, where they engage in farming, fishing, and commercial activities. Within the proposed project area and its environs, settlement patterns are characterized by dispersed rural homesteads interspersed with agricultural land, fishing villages, trading centres, and public institutions.

### 4.4.2. Land-Use Patterns

Land tenure refers to the legal and institutional arrangements that govern the ownership, access, use, and transfer of land. It defines how rights to land are allocated, held, and secured within a particular jurisdiction. In contrast, land disposition pertains to the formal processes and mechanisms through which land ownership or user rights are transferred from one entity to another, either through sale, lease, allocation, inheritance, or other legal instruments. In Kenya, land is broadly classified into three categories: Government land, Private land, and Community (formerly Trust) land.

- Government land is held and managed by the national or county government for public use or future development.

- Private land is held under freehold or leasehold tenure, where individuals or institutions possess full or partial rights to own and use the land.

- Community land, formerly referred to as Trust Land, is held by county governments on behalf of communities and is governed under the Community Land Act, 2016.

Homabay County exhibits a mix of land tenure systems. In urban centers such as Homabay Town, leasehold tenure predominates, where land is leased from the government for defined periods, typically 99 years. Conversely, in rural areas such as Tabla village, freehold tenure is the dominant system, with individuals or families holding permanent ownership, often through inheritance or traditional community allocation. The proposed site (Land based) is situated on privately owned land under freehold tenure.

### 4.4.3. Infrastructural Transport Facilities

Homabay County is served by one Class A1 Road (Kisii–Kisumu), spanning approximately 30 km. Additionally, it has one Class C20 road (Homabay–Rongo) covering around 30 km, two Class C19 roads (Homabay–Mbita and Homabay–Kendu Bay) totaling about 71 km, and one Class C18 road (Rodi Kopany–Sori) extending roughly 32 km. All these Class A and C roads are bitumen-surfaced. The proposed site (Tabla) is located off the (C19) Mbita-Sindo murram road, providing convenient accessibility for operation and maintenance activities. Water transport remains a favorable means of travel between Suba, Mbita, Homa-Bay Town, and Karachuonyo sub-counties, as all four are located along the shores of Lake Victoria. This mode of transport is especially prominent in Mbita, where all 12 islands are primarily accessible to the majority of residents by boat and water bus.

*Plate 7: (C19) Mbita-Sindo Access Road*

### 4.4.4. Energy

In Homabay County, household and community energy use is predominantly based on traditional biomass and petroleum products. Firewood remains the main source of cooking energy for the majority of households, while kerosene (paraffin) is commonly used for lighting, particularly in rural and peri-urban areas. Approximately 57.6% of households rely on firewood for cooking, reflecting the continued dependence on readily available biomass resources. In addition, about 94.6% of households use kerosene for lighting, largely due to affordability and limited access to modern energy alternatives in some rural settlements. Although cleaner energy sources are gradually being adopted, their uptake remains relatively low. Liquefied Petroleum Gas (LPG) is increasingly available in urban centres and trading hubs; however, its relatively high-cost limits widespread use, accounting for less than 1% of total household energy consumption. Solar energy technologies, including solar home systems and solar lanterns, are emerging as viable alternatives for lighting, especially in off-grid and remote areas. However, their adoption is still at an early stage and is mainly concentrated among households with higher income levels or those benefiting from development programmes.

The proposed project area in Nyamanga Sub-Location, Tabla village is relatively well served by the national electricity grid. The presence of nearby power transmission and distribution infrastructure provides a reliable source of electricity to surrounding households, trading centres, and institutions. This grid connectivity is an important enabling factor for development activities in the area, including aquaculture operations, fish handling, storage, and potential value addition facilities.

Overall, while the energy profile of the area is still dominated by traditional sources, the presence of grid electricity and the gradual uptake of renewable energy technologies present opportunities for improved energy access and sustainable development. For the proposed project, access to electricity will support operational efficiency, reduce reliance on fossil fuels, and enhance the sustainability of aquaculture activities, particularly in fish cage farming, cold storage, and post-harvest handling.

### 4.4.5. Economic Activities

The economy of Homabay County is predominantly driven by fishing, agriculture, and a growing service sector, all of which play a significant role in supporting household incomes and contributing to local and regional socio-economic development. Fishing in Lake Victoria remains the principal economic activity within the county. It provides direct employment to a large proportion of the population, particularly communities residing along the lakeshore and on islands such as Rusinga, Mfangano, and Takawiri. The fishery is largely artisanal in nature, with fish harvested from the lake sold to middlemen who supply local markets, urban

centres, and fish processing industries. This value chain supports a wide range of ancillary economic activities, including fish transportation, cold storage, boat operations, net repair services, and fish marketing enterprises.

The fisheries sector also plays a key role in stimulating the growth of the service industry within the county. Fishing hubs along the shoreline have developed into vibrant economic centres, supporting businesses such as boat building and repair workshops, outboard engine maintenance services, fish landing site operations, retail trade, accommodation facilities, and food service establishments including hotels and cafés. These enterprises provide significant employment opportunities, particularly for women and youth engaged in fish trading, vending, and small-scale business activities.

Agriculture also contributes substantially to the county's economy, with many households engaged in crop farming and livestock production. Common agricultural activities include cultivation of maize, sorghum, millet, beans, cassava, and horticultural crops, as well as cattle, goats, and poultry rearing. Agricultural production is primarily subsistence-oriented, although surplus produce is marketed locally and within neighbouring counties. In recent years, aquaculture has emerged as an increasingly important component of the county's Blue Economy strategy. Fish cage farming in Lake Victoria, alongside pond aquaculture on land, is gradually supplementing capture fisheries and enhancing fish supply. This growth is supported by government initiatives, private investment, and technical support from institutions such as the Kenya Fisheries Service and the County Government of Homabay.

*Plate 8: Fishing Boats*

## 5. ANALYSIS OF ALTERNATIVES

In accordance with EIA regulatory requirements, consideration of project alternatives is essential in identifying the most environmentally sustainable and socio-economically viable option for the proposed project. The analysis focuses on site alternatives and technology alternatives for both land-based and lake-based aquaculture systems within the Lake Victoria basin.

### 5.1. No-Project Alternative

The no-project alternative assumes that the proposed aquaculture development will not be implemented. Under this scenario, fish production in the Country would continue to rely heavily on capture fisheries from Lake Victoria and small-scale traditional pond aquaculture.

This alternative would avoid any localized environmental impacts associated with cage installation or pond construction, including nutrient loading, habitat disturbance, and land-use changes. However, it would also maintain existing challenges such as declining fish stocks, overfishing pressure, post-harvest losses, and limited fish supply. Socio-economic benefits associated with employment creation, income diversification, and Blue Economy development would be foregone. Overall, the no-project option is considered environmentally neutral but socio-economically unsustainable in the long term. Therefore, this alternative option was not considered and scoped out for further analysis.

### 5.2. Site Alternatives

#### 5.2.1. Lake-Based Cage Farming Sites

Several potential sites within Lake Victoria were considered, including sheltered bays, open water zones, and nearshore areas. Site selection criteria included water depth, water circulation, proximity to landing sites, ecological sensitivity, navigation routes, and existing fishing activities.

- **Sheltered bays (e.g., Mbita Bay and similar zones):** These areas offer operational advantages such as reduced wave energy, ease of access, and proximity to markets. However, they are environmentally sensitive due to limited water exchange, higher risk of nutrient accumulation, and potential conflicts with artisanal fisheries.
- **Open lake zones:** These areas generally have better water circulation and higher dilution capacity, reducing localized pollution risks. However, they are less preferred due to exposure to strong winds, logistical challenges, and safety risks for operators.
- **Nearshore areas:** These zones are commonly used but present high conflict potential with fishing grounds, navigation routes, and community access points.

Based on this analysis, a balanced approach combining ecological suitability (as guided by KMFRI) and operational feasibility (as regulated by KeFS) was considered optimal for cage sitting. **Land-Based Aquaculture Sites:** Alternative land-based sites were evaluated based on soil suitability, water availability, proximity to infrastructure, and land-use compatibility.

### 5.3. Technology Alternatives

#### 5.3.1. Cage Aquaculture Technology

Two main cage technologies were evaluated and analyzed:

- **Fixed wooden or metal-frame cages:** These are relatively low-cost and commonly used in Lake Victoria. However, they are less durable and require frequent maintenance, especially under rough water conditions.
- **High-density polyethylene (HDPE) floating cages:** These are more durable, resistant to corrosion, and better suited for deeper water conditions. They allow higher stocking densities and improved production efficiency but require higher initial capital investment.

From an environmental and operational perspective, HDPE cages are considered more sustainable due to their durability, reduced maintenance needs, and improved biosecurity control.

#### 5.3.2. Pond and Tank Aquaculture Technology

- **Earthen ponds:** These are low-cost systems suitable for rural settings but are highly dependent on soil permeability and water availability. They are more susceptible to water loss and require careful management to prevent nutrient seepage.
- **Lined ponds and concrete tanks:** These systems offer better water control, improved biosecurity, and higher production efficiency. However, they are more expensive to construct and maintain.
- **Recirculating Aquaculture Systems (RAS):** These represent advanced technology with high water-use efficiency and controlled production conditions. However, they require high capital investment, technical expertise, and reliable energy supply.

Given current local conditions, improved pond systems and semi-intensive tank culture are considered the most feasible land-based technologies.

### 5.4. Conclusion on Alternatives

The analysis indicates that while multiple site and technology options exist, the most sustainable approach is a hybrid aquaculture development model that integrates environmentally suitable lake zones for cage farming and appropriately sited land-based systems for broodstock and supplementary production. HDPE cage technology combined with KMFRI-guided site selection and KeFS regulatory oversight offers the most environmentally sound and economically viable option for lake-based aquaculture. For land-based systems, semi-intensive pond and tank technologies located in suitable inland provides an effective complement.

The preferred alternative balances environmental sustainability, economic feasibility, and social acceptability while supporting the long-term development of aquaculture within Homabay County and the wider Lake Victoria basin.

## 6. STAKEHOLDER AND PUBLIC ENGAGEMENT

Public participation is a vital component of the ESIA process and should be incorporated throughout the entire project lifecycle from design and construction to operation and eventual decommissioning. It provides an opportunity for stakeholders to express their opinions, concerns, and suggestions regarding the proposed project. This consultative and inclusive approach fosters transparency, enhances project acceptability, and ensures that decision-making is informed by the views and interests of the affected and interested parties.

### 6.1. Objectives of Public Consultation

Kenya, recognized as one of the African countries with a progressive constitution, upholds the public's right to participate in decision-making processes that may affect them. Article 10(2)(a) of the Constitution identifies public participation as a fundamental principle of governance. This commitment is further reflected in the EMCA, Cap 387, and the EMCA (Environmental Impact Assessment and Audit) Regulations of 2003, both of which contain clear and stringent provisions mandating public involvement in environmental decision-making processes. The process ensures that all stakeholders are provided with this opportunity as part of a transparent process which allows for a robust and comprehensive environmental study.

Public participation in ESIA is designed to provide sufficient and accessible information to Interested and Affected Parties (I&APs) in an objective manner, enabling them to understand the potential impacts of proposed projects and to contribute meaningfully to the decision-making process. Key objectives of public participation include but are not limited to:

- Disseminate information about the proposed project to the community members or project affected parties,
- Collect views and concerns to be considered in the ESIA,
- Evaluate community perceptions of the project's positive and negative impacts, and
- Gather concerns regarding Environmental and Social Impacts, as well as potential implementation challenges.

### 6.2. Approach and Methodology

Stakeholder engagement for the proposed project was conducted using a staged and structured approach, aligned with the various phases of project development. This approach ensured that consultation activities were timely, targeted, and responsive to the evolving information needs and objectives at each stage of the project. It also promoted effective communication, transparency, and meaningful participation of all Interested and Affected Parties (I&APs) throughout the project lifecycle. The engagement process was organized around two primary phases:

1. Design and Feasibility/Due Diligence Engagement: During this initial phase, stakeholders were consulted to identify potential environmental, social, and economic impacts associated with the proposed project. Key objectives included:
    - Informing the community and regulatory authorities about the project concept and scope.
    - Gathering preliminary input on local concerns, expectations, and priorities.
    - Identifying sensitive receptors and potential mitigation measures early in the project design.

    Engagement activities at this stage included site visits, initial public notices, focused group discussions, and meetings with key regulatory agencies. The information collected informed site selection, preliminary design, and feasibility assessments, ensuring that potential impacts were considered before detailed planning.
2. ESIA Process Engagement: This phase focused on formal consultation in line with EMCA (EIA/EA) Regulations, 2003, ensuring compliance with legal requirements. Objectives included:

- Sharing detailed information on the plant operations, anticipated environmental and social impacts, and mitigation measures.
- Collecting stakeholder feedback and concerns to refine the Environmental and Social Management Plan (ESMP) and operational procedures.
- Ensuring inclusive participation, allowing all I&APs, including local communities, government agencies, and civil society groups, to provide input. Engagement during the ESIA process included public notices, on-site postings, community meetings, written submissions, and one-on-one consultations with affected parties. The feedback obtained will be documented and integrated into project operational protocols, and mitigation strategies to ensure sustainable and socially responsible operations of the batching plant.

By implementing a phased stakeholder engagement approach, the project ensured that consultation activities were systematic, transparent, and responsive to community needs, regulatory requirements, and operational realities, thereby enhancing project acceptance, minimizing potential conflicts, and promoting sustainable development outcomes.

### 6.3. ESIA Process Engagement

#### 6.3.1. Notification of Interested and Affected Parties

A3-sized site notices, written in both English and Kiswahili, have been displayed at strategic locations within and around the operational project site, as well as in public areas. These notices informed local communities and Interested and Affected Parties (I&APs) about the plant's operational activities and invited their participation in the EIA process, in accordance with the requirements of the EMCA (EIA/EA) Regulations, 2003. The notices included technical information on plant operations, production processes, and environmental management measures, and also outlined how I&APs can submit feedback or comments. Following the completion of the EIA study, further stakeholder consultations will be conducted to present the assessment findings, address any concerns, ensure that community and I&AP input is incorporated into the planning of the proposed project.

#### 6.3.2. Public Participation Feedback

The first public consultation meeting for the proposed fish farming was held on **16th June 2026 through Tabla BMU committee, and later** Tabla BMU assembly on the 19th of June 2026. There was a follow-up validation engagement on 13th July 2026 held at the same venue. Both forums/Barazas were attended by the local administration and Tabla Beach Management Unit, and the larger Nyamanga sub location community members.

The deliberations provided a platform for open discussion on various aspects of the proposed development, including its potential social, economic, and environmental impacts on the surrounding communities. Key topics explored during these sessions included anticipated project benefits, concerns regarding possible disruptions, and opportunities for corporate social responsibility (CSR) initiatives aimed at enhancing local welfare. Community members actively engaged by raising questions and sharing their perspectives about the proposed development. For a comprehensive overview of the public engagement, including detailed minutes of the meeting and responses from structured questionnaires, please refer to the annexure of this report.

*Plate 9: Members of Tabla Beach During Public Engagement*

## 7. POTENTIAL ENVIRONMENTAL RISKS AND IMPACTS

Aquaculture (fish farming) is the fastest-growing food production sector globally, helping meet rising seafood demand as wild capture fisheries plateau. Land-based and lake-based (cage) systems are two primary inland approaches, each with distinct advantages, challenges, and potential impacts. The proposed project is expected to generate significant socio-economic and environmental benefits while also presenting potential risks that require careful management. The project aims to enhance fish production, improve seed quality, create employment opportunities, and contribute to food security and household incomes within the project area. Increased availability of high-quality fingerlings is anticipated to support sustainable aquaculture development and reduce pressure on capture fisheries.

### 7.1. Installation and Construction Phase Impacts

#### 7.1.1. Disturbance of Lakebed and Aquatic Habitats

Installation of fish cages will require the deployment of anchors, mooring lines, floats, and other support structures within the lake environment. Anchoring activities may disturb lakebed sediments and benthic habitats through the placement of anchors and movement of installation equipment. Increased sediment suspension may temporarily reduce water clarity and affect aquatic organisms inhabiting the project area. Sensitive habitats, fish breeding grounds, and benthic communities may also be affected if cage locations are not properly selected.

**Mitigation Measures**

- Conduct pre-installation surveys to identify suitable cage locations and avoid ecologically sensitive habitats and fish breeding areas;
- Use environmentally appropriate anchoring systems designed to minimize lakebed disturbance;
- Restrict anchoring and installation activities to designated project areas;
- Minimize the movement of installation vessels and equipment within sensitive aquatic habitat;
- Inspect and maintain mooring systems regularly to prevent anchor dragging and unnecessary disturbance of the lakebed; and
- Restore any disturbed areas where feasible following installation activities.

#### 7.1.2. Increased Water Turbidity and Sedimentation

Construction activities both onshore and within the lake may increase sediment loads in surrounding waters. Excavation, earthworks, shoreline modifications, and cage anchoring operations can result in suspended sediments entering the lake, reducing water clarity and potentially affecting aquatic organisms.

**Mitigation Measures**

- Install erosion and sediment control measures around construction areas;
- Minimize in-water construction activities during periods of heavy rainfall and strong wave action;
- Implement shoreline stabilization measures where necessary;
- Monitor turbidity levels during major construction activities; and
- Rehabilitate disturbed areas immediately after construction.

#### 7.1.3. Land Disturbance and Soil Degradation

During the construction of land-based ponds and hatchery facilities, activities such as site clearing, excavation, and earthworks will result in disturbance of soil and existing land cover. These activities may lead to soil erosion, loss of topsoil, and temporary alteration of land use patterns. If not properly managed,

exposed soils may be washed away by surface runoff, especially during heavy rainfall, leading to sedimentation of nearby water bodies and degradation of soil quality.

**Mitigation Measures:**

- Limit site clearance, excavation, and vegetation removal strictly to designated construction areas to minimize unnecessary land disturbance.
- Clearly demarcate construction boundaries before commencement of works to prevent encroachment into adjacent areas and sensitive habitats.
- Stockpile topsoil separately from subsoil and reuse it during site rehabilitation, landscaping, and revegetation activities following construction.
- Implement erosion and sediment control measures such as earth bunds, silt traps, sediment retention ponds, diversion channels, and contour drains to reduce soil loss and sediment transport.
- Schedule major earthworks and excavation activities during dry weather periods, where practicable, to minimize erosion and runoff.
- Stabilize exposed soils as soon as possible through compaction, mulching, grassing, or revegetation to prevent erosion.
- Minimize the duration for which excavated surfaces and stockpiles remain exposed to wind and water erosion.
- Protect drainage channels, streams, and lake shorelines from sediment-laden runoff through the installation of appropriate barriers and buffer zones.
- Restrict movement of heavy machinery and vehicles to designated access routes to reduce soil compaction and land degradation.
- Regularly inspect construction areas, especially after heavy rainfall events, and promptly repair any erosion features such as gullies, rills, or slope failures.
- Properly manage excavated materials and spoil to prevent uncontrolled deposition and sedimentation of nearby water bodies.
- Restore disturbed areas immediately upon completion of construction works through grading, topsoil replacement, and revegetation using suitable indigenous plant species.

#### 7.1.4. Water Resources Use and Pollution Risk

Construction activities will require water for concrete works, dust suppression, and worker use. Poor management of construction runoff, fuel, or cement residues may result in contamination of surface or groundwater sources. Increased sediment loads from construction areas may also affect nearby water bodies.

**Mitigation Measures:**

- Obtain all necessary water abstraction permits and approvals from the relevant regulatory authorities before commencement of construction activities.
- Use water efficiently through the adoption of water conservation measures and avoid unnecessary abstraction from surface water or groundwater sources.
- Regularly inspect water supply systems to identify and repair leaks, thereby minimizing water losses.
- Prioritize the use of harvested rainwater and recycled water for activities such as dust suppression and equipment cleaning where feasible.
- Prevent the discharge of untreated runoff, wastewater, or contaminated water into rivers, streams, wetlands, Lake Victoria, or other natural watercourses.

- Construct appropriate drainage systems to manage stormwater runoff and prevent erosion, flooding, and sediment transport from construction areas.
- Install sediment control measures such as silt traps, sedimentation ponds, and drainage channels to reduce the movement of suspended solids into nearby water bodies.
- Store fuels, oils, lubricants, paints, cement, and other chemicals in designated, secure, and bunded storage areas away from watercourses and drainage pathways.
- Refuel and service construction equipment only in designated areas equipped with spill containment measures.
- Maintain spill response kits at strategic locations and ensure personnel are trained in spill prevention, containment, and clean-up procedures.
- Immediately contain and remediate any fuel, oil, or chemical spills to prevent contamination of soil and water resources.
- Prohibit the washing of vehicles, machinery, or equipment directly within or near natural water bodies.
- Provide adequate sanitation facilities for construction workers and ensure wastewater is managed and disposed of appropriately.
- Regularly monitor water quality in nearby water bodies where construction activities may pose a contamination risk.

### 7.1.5. Generation of Solid and Liquid Waste

The construction phase of the proposed aquaculture project will generate various types of solid and liquid waste arising from site preparation, excavation works, construction activities, equipment maintenance, and the presence of construction workers. Solid waste streams are expected to include excavated soil and rock materials, construction debris, scrap metal, timber off-cuts, cement bags, plastic packaging materials, empty containers, damaged equipment parts, and domestic waste generated by workers. Liquid wastes may include wastewater from equipment cleaning, concrete works, vehicle washing, sanitation facilities, and accidental spills of fuels, oils, and lubricants. If these wastes are not properly managed, they may accumulate within the project site and surrounding areas, leading to environmental degradation and public health concerns. Improper disposal of construction waste may contaminate soil, surface water, and groundwater resources through the release of sediments, chemicals, oils, and other pollutants. Waste accumulation may also obstruct drainage systems, increasing the risk of localized flooding and erosion, particularly during rainfall events.

**Mitigation Measures:**

- Develop and implement a site-specific Waste Management Plan outlining procedures for waste minimization, segregation, collection, storage, transportation, recycling, and disposal.
- Segregate waste at source into recyclable, reusable, biodegradable, hazardous, and non-recyclable categories using clearly labelled and colour-coded waste receptacles.
- Provide adequate waste collection bins at strategic locations throughout the construction site and ensure regular emptying to prevent overflow and littering.
- Reuse excavated materials, construction debris, and other suitable materials wherever feasible to minimize waste generation.
- Promote recycling of materials such as paper, cardboard, plastics, metals, glass, and packaging materials through licensed recycling service providers.
- Dispose of non-recyclable waste only through licensed waste handlers and at approved disposal facilities in accordance with applicable environmental regulations.

- Establish designated waste storage areas that are secure, well maintained, and protected from wind, rainfall, and scavenging animals.
- Ensure hazardous wastes such as used oils, lubricants, paint residues, chemical containers, batteries, and contaminated materials are stored, handled, transported, and disposed of separately in accordance with legal requirements.
- Prohibit open dumping, open burning, and disposal of waste into water bodies, wetlands, drainage channels, or other environmentally sensitive areas.
- Provide adequate sanitation facilities for construction workers and ensure proper collection, treatment, and disposal of sewage and wastewater.
- Implement good housekeeping practices to maintain a clean and orderly construction site at all times.
- Conduct regular inspections of waste storage and disposal areas to identify and address potential environmental risks.
- Train workers on proper waste handling, segregation, storage, and disposal procedures.
- Maintain records of waste generation, recycling, transportation, and disposal to facilitate monitoring and regulatory compliance.
- Engage licensed waste management service providers for the collection, transportation, treatment, and disposal of waste generated during construction.

#### 7.1.6. Air Quality Deterioration and Noise Pollution

Construction machinery, vehicles, and earth-moving activities are likely to generate dust, exhaust emissions, and noise. These impacts may temporarily affect workers and nearby communities, causing discomfort and potential health concerns.

**Mitigation Measures:**

- Regularly sprinkle water on exposed soils, access roads, excavation areas, and other dusty surfaces to suppress dust generation, particularly during dry and windy conditions.
- Cover trucks transporting soil, sand, gravel, and other loose materials to prevent dust emissions during transportation.
- Limit vehicle speeds within the construction site and along access roads to reduce dust generation.
- Maintain construction equipment, machinery, generators, and vehicles in good working condition through regular servicing and maintenance to minimize exhaust emissions and excessive noise.
- Avoid unnecessary idling of vehicles and machinery when not in use to reduce fuel consumption, air emissions, and noise levels.
- Use modern, fuel-efficient, and low-emission equipment wherever feasible.
- Stockpile construction materials in designated areas and cover fine materials that are susceptible to wind dispersal.
- Restrict construction activities to normal daytime working hours to minimize noise disturbance to nearby residents, institutions, and other sensitive receptors.
- Schedule particularly noisy activities during periods least likely to affect surrounding communities.
- Install silencers, mufflers, and noise suppression devices on generators, compressors, and heavy machinery where appropriate.
- Position stationary noise-generating equipment away from residential areas and other sensitive receptors whenever practicable.

- Establish temporary noise barriers or acoustic screens around high-noise construction activities where necessary.
- Provide workers with appropriate Personal Protective Equipment (PPE), including dust masks, respirators, ear plugs, and ear muffs, depending on the nature of their work and exposure levels.
- Conduct regular monitoring of dust levels, air quality, and noise levels to ensure compliance with applicable environmental and occupational health standards.

### 7.1.7. Occupational Health and Safety Risks

The construction phase of the proposed aquaculture project will involve a range of activities, including site clearing, excavation, earthworks, construction of ponds and hatchery facilities, installation of utilities, transportation of materials, and cage anchoring works within Lake Victoria. These activities may expose workers to various occupational health and safety hazards if not properly managed.

Potential risks include slips, trips, and falls; injuries from the operation of heavy machinery and construction equipment; cuts and abrasions from tools and materials; electrocution from temporary electrical installations; and accidents involving construction vehicles and equipment. Workers may also be exposed to dust, exhaust emissions, excessive noise, vibration, and hazardous substances such as fuels, oils, paints, and cement products. Prolonged exposure to these hazards may result in respiratory illnesses, hearing impairment, eye irritation, skin disorders, and other occupational health problems. Construction activities near or on Lake Victoria, including cage installation and anchoring operations, may present additional risks such as drowning, boat accidents, falls into water, and injuries associated with lifting and handling heavy equipment. Manual handling of construction materials may also result in musculoskeletal injuries if proper procedures are not followed.

**Mitigation Measures:**

- Comply with the provisions of the Occupational Safety and Health Act (OSHA), 2007, and all other applicable occupational health and safety regulations.
- Develop and implement a site-specific Occupational Health and Safety (OHS) Management Plan for all construction activities.
- Conduct comprehensive safety induction and awareness training for all workers before commencement of work and provide regular refresher training throughout the construction period.
- Undertake task-specific training for workers involved in specialized activities such as excavation, electrical works, operation of heavy machinery, welding, working at heights, and in-water construction activities.
- Provide appropriate PPEs including safety helmets, safety boots, gloves, high-visibility vests, hearing protection, eye protection, respiratory masks, and life jackets for personnel working on or near water.
- Enforce the proper use, maintenance, and replacement of PPE at all times while on site.
- Install adequate warning signs, safety notices, barriers, and restricted access controls around hazardous work areas.
- Ensure that all machinery, tools, and equipment are regularly inspected, maintained, and operated only by trained and authorized personnel.
- Conduct routine risk assessments and job hazard analyses to identify potential hazards and implement appropriate control measures.
- Provide and maintain fully stocked first-aid kits at strategic locations throughout the site and ensure that trained first-aiders are available during all working hours.

- Establish emergency preparedness and response procedures covering accidents, injuries, fires, drowning incidents, equipment failure, chemical spills, and extreme weather events.
- Provide emergency communication equipment and maintain readily accessible emergency contact information for medical facilities, emergency services, and project management personnel.
- Develop and implement fire prevention and response measures, including provision of suitable fire extinguishers, staff training, and periodic fire drills.
- Ensure safe storage, handling, and transportation of fuels, chemicals, and hazardous substances in designated areas.

### 7.1.8. Socio-Economic Impacts and Community Interaction

The construction phase of the proposed aquaculture project at Tabla Beach, is expected to generate positive socio-economic benefits through the creation of temporary employment opportunities for local residents. Employment opportunities may arise in activities such as site preparation, excavation, construction of ponds and hatchery facilities, cage installation, transportation, security services, and provision of goods and services. The project may also stimulate local economic growth by increasing demand for accommodation, food supplies, transport services, construction materials, and other locally available goods and services.

Despite these anticipated benefits, the influx of construction workers and increased project-related activities may also result in adverse social impacts if not properly managed. Increased demand for water, sanitation, housing, healthcare, and other social services may place pressure on existing community infrastructure. Differences in income levels, competition for employment opportunities, and perceived inequities in benefit sharing may create tensions between local residents and project workers. In addition, interactions between workers and local communities may increase the risk of social conflicts, cultural misunderstandings, gender-based violence, sexual harassment, the spread of communicable diseases, including HIV/AIDS and other sexually transmitted infections, and concerns related to security and public safety. Construction traffic and movement of machinery may also affect local mobility and increase safety risks for community members.

**Mitigation Measures**

- Prioritize recruitment of qualified local labor and procurement of locally available goods and services where feasible to enhance local economic benefits and community support for the project.
- Implement a transparent and non-discriminatory recruitment process that provides equal employment opportunities regardless of gender, age, disability, ethnicity, or social status.
- Sensitize all workers and contractors on community relations, local customs, cultural values, and acceptable conduct within the host communities.
- Develop and enforce a Workers' Code of Conduct outlining expected behavior, respect for local traditions, prohibition of harassment, discrimination, and other forms of misconduct.
- Establish and maintain an accessible, transparent, and effective Grievance Redress Mechanism (GRM) to receive, document, investigate, and resolve community complaints and concerns in a timely manner.
- Conduct regular stakeholder engagement and consultation meetings with local communities, community leaders, Beach Management Units (BMUs), and other relevant stakeholders throughout the construction period.
- Ensure compliance with all applicable labor laws, occupational health and safety regulations, and international labor standards regarding wages, working hours, leave, non-discrimination, and workers' welfare.

- Provide fair terms and conditions of employment, including written contracts, timely payment of wages, and access to grievance procedures for workers.
- Implement awareness programs on HIV/AIDS, sexually transmitted infections (STIs), gender-based violence (GBV), sexual exploitation and abuse (SEA), substance abuse, and communicable disease prevention.
- Prohibit child labor, forced labor, and all forms of exploitation in accordance with national legislation and international labor standards.

### 7.2. Operational Impacts

#### 7.2.1. Diseases and Parasites

Diseases and parasitic infections in aquaculture are primarily caused by stress that depresses the fish's immune system. When fish are farmed under best management practices in both cage and land-based systems in Lake Victoria, disease outbreaks are highly unlikely. Maintaining optimal water quality, adequate dissolved oxygen levels, proper feeding regimes, and appropriate stocking densities remain the most effective way to ensure fish health.

In land-based systems such as ponds and tanks, reducing stocking density usually improves fish health and lowers disease pressure. In cage farming, good site selection with adequate water exchange and depth, regular net cleaning to maintain water flow, and avoiding overstocking are essential. Poorly managed cages can lead to rapid disease spread, particularly when water quality declines or when cages are placed too close together. Clarias (catfish) species are more tolerant of higher densities, but they still benefit significantly from good water quality and proper husbandry. The highest risk of disease and pathology occurs in hatcheries, where fish are most vulnerable. Strict biosecurity protocols are therefore essential in these facilities.

**Mitigation Measure**

- Aquaculture farmers must be aware of the impacts that fish disease could have and must manage units so as to prevent infection, whilst being able to deal with any outbreaks effectively if they occur;
- No aquaculture organisms may be imported into the aquaculture production facility from unrecognised sources, and all imported ova and fingerlings need to be certified disease free by the supplier;
- It is required to have all stock checked and certified as disease free prior to introducing such organisms into the production facility;
- Treatment of diseases must be done by recognised methods and under the guidance of recognised aquaculture pathologists. All treatments must be recorded; and
- The storage and use of aquaculture chemicals and medications must be done in a safe and responsible manner as per the relevant Material Safety Data Sheet (MSDS).
- If greater numbers die (more than 0.1% of the stock) or if the associated behaviour of the organisms indicates a problem, the first step is to monitor the physical and chemical characteristics of the water (temperature, pH, oxygen content, etc.). Failing the detection of any adverse water conditions a recognised pathologist should be approached to determine the cause;
- Dead aquatic organisms must be removed from the production systems as soon as they are detected. If samples are required for diagnostic purposes, these must be taken and appropriately stored for this purpose.

#### 7.2.2. Water Quality (Pollution)

The potential for the deterioration of water quality in the receiving ecosystem as a result of fish farm intensification is considered high if no mitigation and monitoring is implemented. Organic enrichment mainly

produced by overfeeding and over fertilisation can result in the eutrophication of water especially in systems that are not filtered or flushed regularly. As aquaculture waste originates mainly from the metabolism and excrement of the fish, as well as from waste feed, it is typically rich in carbon, nitrogen and phosphorous. With the above mentioned in mind, water quality is a crucial aspect of aquaculture and needs to be monitored closely to prevent contamination of the receiving ecosystems and compromising operations.

**Mitigation Measures**

- Regularly monitor key water quality parameters, including dissolved oxygen, temperature, pH, turbidity, Secchi depth, nutrients (nitrogen and phosphorus), chlorophyll-a, algal cell counts and species composition, ammonia, nitrite, nitrate, biochemical oxygen demand (BOD), and total suspended solids (TSS).
- Implement a comprehensive water quality monitoring program with clearly defined sampling locations, frequencies, and reporting procedures.
- Optimize feeding practices to minimize feed wastage and nutrient loading by using high-quality feeds, appropriate feeding rates, and efficient feeding techniques.
- Conduct routine inspection and maintenance of cages, ponds, water intake systems, and drainage structures to prevent water contamination and ensure efficient water circulation.
- Avoid overstocking of fish to maintain carrying capacity limits and reduce excessive organic matter accumulation.
- Install aeration systems where necessary to maintain adequate dissolved oxygen levels and improve water circulation.
- Remove accumulated sludge, sediment, and organic debris from ponds and settling facilities on a regular basis to prevent nutrient buildup and deterioration of water quality;
- Ensure proper treatment of pond effluent through sedimentation ponds, constructed wetlands, or other suitable treatment systems before discharge into the environment;
- Implement biosecurity measures to prevent disease outbreaks that could necessitate excessive use of chemicals or antibiotics.
- Restrict the use of chemicals, disinfectants, and veterinary products to approved substances and apply them strictly according to manufacturer recommendations and regulatory requirements.
- Develop and implement an emergency response plan to address incidents such as fish mortality events, algal blooms, chemical spills, and water quality deterioration;
- Monitor upstream and downstream water quality to assess the project's influence on receiving water bodies and facilitate adaptive management;
- Conduct periodic environmental audits and water quality assessments to evaluate the effectiveness of mitigation measures and identify areas for improvement; and
- Maintain records of water quality monitoring results and use the data to guide adaptive management decisions aimed at sustaining optimal fish health and environmental quality.

### 7.2.3. Air Emissions

It is often difficult to accurately predict the magnitude of air emission impacts during the planning stage of a project. However, fish feed milling operations are expected to generate airborne dust, particularly during feed ingredient grinding, bulking, and drying processes. Dust emissions may arise from the handling and processing of raw materials, potentially affecting air quality within and around the facility. In addition, auxiliary equipment such as diesel-powered generators may produce exhaust emissions, including particulate matter, carbon monoxide, nitrogen oxides, sulphur oxides, and greenhouse gases. If not properly managed, these emissions could contribute to localized air quality deterioration. Nevertheless, with the implementation

of appropriate dust suppression measures, proper equipment maintenance, and adherence to environmental regulations, the anticipated air emission impacts are expected to be minimal and manageable.

**Mitigation Measures**

- Install dust control measures in feed milling and processing areas, including enclosed processing equipment, dust extraction systems, and adequate ventilation;
- Regularly clean feed storage, processing, and handling areas to prevent the accumulation and dispersal of dust;
- Store feed ingredients and finished products in enclosed structures or covered containers to minimize fugitive dust emissions;
- Maintain all generators, vehicles, and machinery in accordance with manufacturer specifications to ensure efficient combustion and reduced emissions;
- Use energy-efficient equipment and adopt preventive maintenance schedules to minimize fuel consumption and exhaust emissions;
- Where feasible, utilize cleaner energy sources or grid electricity to reduce reliance on diesel-powered generators;
- Implement proper waste management practices and promptly remove fish mortalities to prevent the generation of offensive odours;
- Maintain good housekeeping practices throughout the facility to minimize dust and odour emissions;
- Establish vegetative buffers around operational areas where feasible to help trap dust and improve local air quality;
- Provide workers with appropriate PPEs, including dust masks and respirators where necessary;
- Conduct periodic air quality and occupational health monitoring, particularly in feed milling and processing areas; and
- Ensure compliance with applicable national environmental, occupational health, and air quality regulations.

### 7.2.4. Habitat Degradation

The destruction of habitats for the establishment of aquaculture farms will be negative if the habitat is considered ecologically or economically important. Such areas would include breeding, nesting, nursery and foraging areas for a range of species with emphasis on rare and endangered species and species of conservation importance. The construction of ponds and associated infrastructure will require rudimentary earthworks. These earthworks and the clearing of vegetation may lead to erosion and the smothering of habitat through the associated deposition. Poor environmental management (at both pond and cage operations) could result in the pollution of receiving water resources. This could negatively affect the health of indigenous aquatic species. The establishment of cages in the Lake will smother existing habitats. Sensitive habitats such as fish breeding areas, must be identified prior to cage establishment and avoided.

**Mitigation Measures**

- Site cages, ponds, and associated infrastructure away from ecologically sensitive habitats, breeding grounds, wetlands, and areas of high biodiversity value;
- Minimize vegetation clearance and land disturbance during construction and operation activities;
- Implement proper feed management practices to reduce feed wastage and nutrient accumulation in the aquatic environment;
- Maintain optimal stocking densities to minimize organic loading and environmental stress;
- Conduct regular monitoring of sediment quality, benthic conditions, and aquatic biodiversity around cage sites;

- Rotate cage locations, where feasible, to allow for natural recovery of affected benthic habitats;
- Establish vegetative buffer zones around land-based facilities to reduce erosion, sedimentation, and surface runoff;
- Properly manage solid waste, wastewater, and fish mortalities to prevent environmental contamination;
- Develop and implement spill prevention and response procedures for fuels, oils, and chemicals;
- Restore disturbed areas through revegetation and habitat rehabilitation measures following construction activities;
- Monitor water quality parameters regularly and implement corrective measures where deterioration is detected;
- Comply with environmental management requirements established by relevant regulatory authorities and implement recommendations from environmental monitoring programs; and
- Conduct periodic environmental audits to assess the effectiveness of habitat protection measures and identify opportunities for improvement.

### 7.2.5. Risks to Indigenous Fish Species

**The** proposed aquaculture project involves the culture of Nile tilapia (*Oreochromis niloticus*), a species that is already widely distributed and extensively farmed within the Lake Victoria Basin and throughout Kenya. Although the species is well established in the region, aquaculture activities may still pose risks to indigenous fish populations and aquatic biodiversity if not properly managed. Potential impacts may arise from the accidental escape of cultured fish from ponds, cages, or other containment systems. Escaped fish may compete with native species for food, habitat, and breeding grounds, potentially altering ecosystem dynamics. Where genetically distinct strains are cultured, there is also a possibility of genetic interaction with wild populations, which may affect the genetic integrity of indigenous fish stocks. The movement of broodstock, fry, and fingerlings between hatcheries and production sites may increase the risk of introducing and spreading fish diseases, parasites, and other pathogens to wild fish populations. Disease outbreaks could negatively affect both cultured and naturally occurring fish species within the project area and the wider Lake Victoria ecosystem.

**Mitigation Measures**

- Source broodstock, fry, and fingerlings only from certified hatcheries approved by the Kenya Fisheries Service (KeFS);
- Comply with all applicable fisheries, aquaculture, and biosecurity regulations governing fish movement and stocking;
- Implement strict biosecurity measures to prevent the introduction and spread of fish diseases and parasites;
- Conduct regular fish health monitoring and disease surveillance in accordance with approved fish health management protocols;
- Minimize fish escape incidents through the use of robust cage designs, secure pond embankments, predator-resistant netting, and routine infrastructure inspections;
- Maintain appropriate stocking densities to reduce fish stress and susceptibility to disease outbreaks;
- Quarantine new fish stocks before introduction into existing production systems;
- Use only approved chemicals, disinfectants, and veterinary products in accordance with manufacturer instructions and regulatory requirements;
- Prohibit the discharge of untreated wastewater containing chemicals, medications, or other contaminants into natural water bodies;

- Establish effluent treatment and water quality management systems to prevent contamination of the surrounding aquatic environment;
- Maintain detailed records of fish movements, health status, treatments administered, and mortality events;
- Promptly report unusual disease outbreaks or mass fish mortality events to the Kenya Fisheries Service and other relevant authorities;
- Undertake periodic environmental monitoring to assess potential impacts on wild fish populations and aquatic biodiversity; and
- Train farm personnel on biosecurity, disease prevention, fish health management, and environmental protection measures.

#### 7.2.6. Potential Fish Escapees

Fish escapees may occur from the aquaculture facility due to damage to containment structures, equipment failure, extreme weather events, flooding, operational errors, or inadequate handling during stocking and harvesting activities. Escaped fish have the potential to interact with wild fish populations, which may result in competition for food and habitat, transmission of diseases and parasites, genetic dilution of native stocks through interbreeding, and disruption of local aquatic ecosystems.

The significance of this impact will depend on the species cultured, the scale of escape events, and the ecological sensitivity of the receiving environment. However, with the implementation of robust containment systems, regular inspection and maintenance of cages, nets, and pond embankments, installation of predator-resistant barriers, and adherence to best aquaculture management practices, the risk of fish escapees can be substantially minimized.

**Mitigation Measures**

- Install screens on all inlet and outlet points in the fish farm to minimize the escape of fry, juveniles and broodstock;
- Filter screens in fish farms shall be designed to retain the smallest life stage present;
- Cages should be made of sturdy, non-corrosive materials;
- Make thorough inspection of nets before they are deployed so as to avoid possible escapees from the cages;
- Follow protocols when transferring, changing nets or harvesting fish from the cages e.g. use
- of fish boxes;
- Divers or underwater cameras must periodically inspect cages for holes, rips and tears;
- No production stock may be kept in settlement and filtration ponds or any other unit not specifically designated as part of the production cycle;
- The moving of fish (cage stocking, grading and harvesting) must be done in a manner, which prevents escape; and
- During the inspection of fish, a 'catch net' must be placed between the working platform where the fish are being handled and the open water. This must ensure that any fish that mistakably fall on the working deck must not escape.

#### 7.2.7. Cage Structure Failure and Loss of Fish Stock

Cage structure failure may occur as a result of poor construction, material fatigue, inadequate maintenance, vandalism, collision with boats, predator damage, or extreme weather conditions such as strong winds, waves, and storms. Failure of cage systems can lead to the escape of cultured fish into the natural environment and significant loss of fish stock, resulting in economic losses to the project proponent. Escaped

fish may also interact with wild fish populations, potentially causing ecological impacts such as competition for resources, disease transmission, and genetic interference with native species. The severity of this impact depends on the scale of the cage failure and the number of fish released.

**Mitigation Measures**

- The cage anchor lines must be regularly (once a month) inspected to ensure the stable positioning and anchoring of the cage system at all times;
- Cage platforms must be kept in good order (clean, tidy and free of unnecessary equipment etc.);
- Cage netting must be kept clean, free of algal growth and free of any damage or holes that could lead to fish escape or the penetration of predators;
- No chemicals may be used in the cleaning of the cage nets unless approval is obtained from the relevant authorities;
- The HDPE piping of floating cage collars must be checked for corrosion and leaks so that these can be repaired or replaced if necessary; and
- The cage units may be moved from time to time to lessen the localised build-up of organic sediments directly underneath the cage facilities. These positions must remain within the areas zoned/approved for the operation of the cage culture system.

### 7.2.8. Chemical Spills and Incorrect Application of Chemicals

Chemical spills and the improper application of chemicals may occur during the storage, handling and use of substances such as disinfectants, water treatment agents, fuels, lubricants, and veterinary products used in aquaculture operations. Such incidents may result from inadequate storage facilities, equipment failure, human error, lack of training, or non-compliance with operational procedures. Improper chemical use or accidental spills can contaminate water bodies, soil, and surrounding habitats, leading to adverse effects on aquatic organisms, wildlife, and water quality. Excessive or incorrect application of chemicals may also cause fish stress, mortality, bioaccumulation of harmful substances, and disruption of aquatic ecosystem functions. In addition, chemical exposure may pose health and safety risks to workers and nearby communities.

**Mitigation Measures**

- The use of chemicals must be done in a responsible manner and operators must ensure that no downstream environmental impacts emanate from such chemical use;
- Chemicals must be used for specific and not general purposes;
- The handler must wear appropriate PPE;
- Dosages, application methods and resultant outcome must be known and recorded in a treatment register;
- Chemicals must be stored in a dry, well-ventilated and lockable chemical store;
- Chemical purchase dates, use and expiry dates must be recorded;
- Expired chemicals must be disposed of at a suitable hazardous waste disposal site;
- The advice of a recognised fish pathologists or aquaculturists must be sought where the application of chemicals is uncertain.

### 7.2.9. Endangering Predators

Aquaculture operations may inadvertently endanger natural predators such as birds, reptiles, and aquatic mammals that are attracted to fish cages, ponds, or feed sources. Predators may become entangled in nets, exclusion devices, or other infrastructure, leading to injury, stress, or mortality. In some cases, conflicts between aquaculture operators and predators may result in disturbance, displacement, or intentional harm

to wildlife. The presence of aquaculture facilities may also alter predator behavior and feeding patterns, potentially affecting the ecological balance of the surrounding environment. These impacts are particularly significant in areas that support protected, endangered, or ecologically important species.

**Mitigation Measures**

- Bird netting must be positioned so as not to hinder the natural movement of the birds. They should be visible to the birds;
- No traps may be used to injure any predators of aquaculture organisms. Traps may only be set if these predators can be caught live (without injury) for translocation to alternative areas. This may only be done under the supervision of recognised organisations or authorities;
- No poisons may be left out for aquaculture predators;
- No animals that prey on the aquaculture species may be shot;
- The main aquaculture predators and their control methods include cover netting for birds (Cormorants, Kingfishers, Fish Eagles, Herons, Storks and others) and fencing and netting for otters.

### 7.2.10. Pond Effluent

Aquaculture ponds generate effluent containing suspended solids, uneaten feed, fish excreta, nutrients (particularly nitrogen and phosphorus), organic matter, and, in some cases, residual chemicals used in pond management. During routine water exchange, pond draining, harvesting, or cleaning activities, these effluents may be discharged into the surrounding environment. If not properly managed, pond effluent can degrade water quality in receiving water bodies by increasing nutrient concentrations, biochemical oxygen demand, and sediment loads. This may lead to eutrophication, algal blooms, reduced dissolved oxygen levels, and adverse impacts on aquatic ecosystems and biodiversity. The discharge of untreated effluent may also affect downstream water users and aquatic habitats.

**Mitigation Measures**

- The introduction of the hapa system will minimize nutrient loading from pond drainage by reducing the need for frequent pond emptying and water exchange;
- Minimize effluent discharge by reducing the frequency of pond draining and adopting water conservation practices wherever feasible;
- Establish settling ponds to retain effluent for at least 48 hours, allowing suspended solids to settle and promoting the breakdown and hydrolysis of organic matter before discharge;
- Utilize the natural activity of anaerobic bacteria within settling ponds to facilitate the decomposition and stabilization of organic matter;
- Ensure that water intake and effluent discharge points are located separately and operate independently to prevent cross-contamination between incoming water supplies and discharged effluent; and
- Regularly monitor effluent quality and maintain treatment facilities to ensure compliance with applicable environmental standards and regulatory requirements.

### 7.2.11. General Waste Resulting in Environmental Contamination

The proposed aquaculture project will generate various types of general waste during both the construction and operational phases. These may include food waste, packaging materials, plastics, paper, cardboard, used sacks, scrap materials, damaged equipment, and domestic waste generated by workers and visitors. If not properly managed, the accumulation, improper storage, or indiscriminate disposal of such waste may lead to environmental contamination. Poor waste management practices can result in soil and water pollution

through the leaching of contaminants into surface water and groundwater systems. Improperly disposed waste may also obstruct drainage channels, create breeding grounds for disease vectors such as rodents and insects, generate unpleasant odours, and degrade the aesthetic quality of the surrounding environment. Lightweight materials such as plastics may be transported by wind or runoff into aquatic ecosystems, where they can harm fish, birds, and other wildlife through ingestion or entanglement. In addition, uncontrolled waste disposal may pose public health risks to workers and nearby communities.

**Mitigation Measures**

- Develop and implement an Integrated Waste Management Plan for the project;
- Segregate waste at source into recyclable, organic, hazardous, and non-recyclable categories using clearly labelled and colour-coded waste bins;
- Provide adequate waste collection bins at strategic locations throughout the facility;
- Ensure regular collection and disposal of waste to prevent accumulation and littering;
- Reuse and recycle materials such as plastics, paper, cardboard, metal, and packaging materials wherever feasible;
- Engage licensed and authorized waste handlers for transportation and disposal of non-recyclable wastes at approved disposal facilities;
- Compost biodegradable and organic waste where practical and environmentally appropriate.
- Prohibit open dumping, open burning, and disposal of waste into water bodies, wetlands, or drainage channels;
- Conduct regular housekeeping and site-cleaning activities to maintain cleanliness and prevent waste accumulation;
- Train workers on proper waste segregation, handling, storage, and disposal procedures;
- Establish designated waste storage areas that are secure, well maintained, and protected from wind, rainfall, and animal scavenging;
- Undertake routine inspections and audits of waste management practices to ensure compliance with environmental regulations and project requirements;
- Promote waste minimization through efficient procurement, material handling, and resource-use practices; and
- Maintain records of waste generation, recycling, transportation, and disposal to facilitate monitoring and continuous improvement.

### 7.2.12. Ice Processing Plant Operations

The ice processing plant will be used to produce and store ice for fish preservation during harvesting, handling, transportation, and marketing. The operation of the facility may result in environmental impacts associated with energy consumption, water use, wastewater generation, noise emissions, refrigerant leakage, and solid waste generation from packaging and maintenance activities. Wastewater generated from equipment cleaning, floor washing, and melting ice may contribute to localized water pollution if discharged without proper management. Refrigeration systems may also pose environmental risks through accidental leakage of refrigerants, which can contribute to ozone depletion or global warming depending on the type of refrigerant used. In addition, compressors, pumps, and other mechanical equipment may generate noise that could affect workers and nearby receptors.

**Mitigation Measures**

- Install water-efficient ice-making equipment and implement water conservation measures;
- Collect and properly manage wastewater from cleaning and operational activities before discharge;

- Conduct regular inspection and maintenance of refrigeration systems to prevent refrigerant leaks;
- Use environmentally friendly refrigerants with low ozone depletion and global warming potential where feasible;
- Install noise control measures, including equipment enclosures, silencers, and routine maintenance of machinery;
- Provide adequate drainage systems to prevent water stagnation and localized flooding;
- Implement good housekeeping practices and regular cleaning schedules;
- Segregate and properly dispose of solid waste generated from operations and maintenance activities;
- Train personnel on equipment operation, emergency response procedures, and environmental management practices;
- Monitor water consumption, energy use, and wastewater quality to improve operational efficiency and environmental performance; and
- Ensure compliance with applicable environmental, occupational health, and safety regulations.

#### 7.2.13. Fish Health

Good husbandry is critical for aquatic animal health. Maintaining proper environmental conditions, selecting healthy fish, providing a nutritious diet, minimising stress, vaccinating fish, and rapidly diagnosing, isolating, and treating disease outbreaks are important aspects of good husbandry in the aquaculture systems.

**Mitigation Measures**

- Ensure compliance with the Fisheries (Safety of Fish, Fishery Products and Fish Feed) Regulations, 2007, and all relevant guidelines and standards issued by the Kenya Fisheries Service (KeFS).
- Obtain all necessary permits, certifications, and approvals from KeFS and facilitate periodic inspections to ensure adherence to national aquaculture health and biosecurity requirements.
- Prioritize disease prevention as the primary line of defence against disease outbreaks through the implementation of good aquaculture management practices.
- Apply appropriate animal husbandry and farm management practices to minimize stress and enhance fish health and welfare.
- Maintain optimal water quality parameters in all hatchery, nursery, pond, cage, and pen culture systems through routine monitoring and corrective actions.
- Conduct regular inspections of fish stocks to observe behaviour, detect early signs of disease, stress, injury, or abnormal mortality, and initiate timely interventions.
- Use stocking densities, handling procedures, and feeding regimes appropriate to the cultured species, life stage, and environmental carrying capacity.
- Ensure that stocking densities remain within the holding capacity of the production system and receiving environment to prevent overcrowding and deterioration of water quality.
- Promptly remove and properly dispose of dead, diseased, or moribund fish in a manner that does not compromise the health and welfare of the remaining stock or contaminate the environment.
- implement comprehensive biosecurity measures, including controlled access to production areas, disinfection of equipment, quarantine procedures for new stock, and movement controls where necessary.
- Source broodstock, fry, and fingerlings from certified and reputable hatcheries approved by KeFS to reduce the risk of disease introduction.
- Utilize vaccines, immunostimulants, probiotics, and other approved preventive health measures where appropriate and in accordance with veterinary and fisheries regulations.

- Maintain accurate records of fish health, disease occurrences, treatments administered, mortalities, water quality monitoring results, and biosecurity inspections.
- Develop, implement, and periodically review a site-specific Fish Health Management Plan for each farm facility, outlining disease prevention, surveillance, reporting, treatment, and emergency response procedures.
- Report notifiable disease outbreaks and unusual fish mortality events to KeFS and other relevant authorities in accordance with regulatory requirements.
- Provide regular training to farm personnel on fish health management, disease recognition, biosecurity protocols, and emergency response procedures.

### 7.2.14. Biosecurity

Biosecurity is a critical component of sustainable aquaculture management and plays a fundamental role in safeguarding fish health, maintaining productivity, and protecting the surrounding aquatic environment. The prevention of pathogen introduction, establishment, and spread is essential for the success of intensive aquaculture operations and remains one of the most significant challenges facing the global aquaculture industry. Effective biosecurity measures are designed to minimize the risk of disease outbreaks by controlling potential pathways through which pathogens, parasites, and invasive organisms may enter or spread within production systems. These pathways may include the movement of fish, water, equipment, personnel, vehicles, feed, and other materials associated with farm operations.

**Mitigation Measures**

- Develop and implement a comprehensive Biosecurity Management Plan covering all hatchery, nursery, pond, cage, and fish handling operations;
- Ensure compliance with all applicable fisheries, veterinary, and aquaculture regulations, including guidelines issued by the Kenya Fisheries Service (KeFS);
- Restrict access to production areas through controlled entry points and maintain visitor logs for all personnel entering the facility;
- Establish quarantine procedures for all newly acquired broodstock, fry, fingerlings, and other aquatic organisms before introduction into production systems;
- Source broodstock, fry, fingerlings, and fish feed only from certified and reputable suppliers with documented health records;
- Conduct routine fish health surveillance and inspections to identify early signs of disease, stress, injury, or abnormal behaviour;
- Regularly monitor and maintain optimal water quality parameters, including dissolved oxygen, temperature, pH, ammonia, nitrite, and turbidity;
- Clean and disinfect equipment, nets, cages, tanks, vehicles, and other farm infrastructure before and after use to prevent disease transmission;
- Install footbaths, handwashing stations, and disinfection points at strategic locations within the facility;
- Prohibit the sharing of equipment between production units unless properly cleaned and disinfected;
- Implement strict protocols for handling, transport, stocking, grading, and harvesting fish to minimize stress and reduce disease susceptibility;
- Promptly remove and safely dispose of dead, diseased, or moribund fish through approved methods to prevent pathogen proliferation.
- Control predators, pests, and vectors such as birds, rodents, insects, and other animals that may transmit diseases between production units;

- Maintain appropriate stocking densities in accordance with species requirements and the carrying capacity of the culture system;
- Use vaccines, probiotics, immunostimulants, and approved fish health products where appropriate and under professional guidance;
- Minimize unnecessary use of antibiotics and other therapeutants, ensuring that any treatments comply with regulatory requirements and best aquaculture practices;
- Maintain detailed records of fish health monitoring, mortalities, treatments, disease incidents, water quality data, and biosecurity inspections;
- Train all farm personnel on biosecurity procedures, disease recognition, hygiene requirements, and emergency response protocols;
- Establish contingency and emergency response procedures for disease outbreaks, including isolation of affected units and notification of relevant authorities; and
- Conduct regular biosecurity audits and reviews to evaluate the effectiveness of control measures and implement corrective actions where necessary.

## 7.3. Social Risks

### 7.3.1. User Conflicts

The development and operation of the proposed integrated land-based and lake-based aquaculture project at Tabla Beach, Suba North Sub-County, Homabay County, has the potential to generate user conflicts arising from competition over access to land, water resources, fishing grounds, and other natural resources. Communities residing around Tabla Beach and the wider Lake Victoria basin are heavily dependent on fisheries, small-scale agriculture, livestock keeping, and other lake-related economic activities for their livelihoods. The establishment of fish cages, support infrastructure, and associated aquaculture facilities may be perceived as restricting access to traditional fishing grounds, fish landing areas, navigation routes, or shoreline resources utilized by local fishermen and community members. Such restrictions could result in tensions between the project proponent and resource users, particularly if stakeholders perceive that their livelihoods, access rights, or economic opportunities are being adversely affected. Potential conflicts may also arise from concerns related to water use, environmental impacts, ownership and use of lake space, and competition for suitable sites within the beach management area. In addition, the influx of workers and increased economic activity associated with the project may place additional pressure on local resources and services if not properly managed.

**Mitigation Measures**

- Obtain all relevant permits, licenses, and approvals from the relevant government agencies before project implementation;
- Undertake continuous stakeholder engagement and consultation with local communities, fishermen, fish traders, Beach Management Units (BMUs), county government representatives, and other resource users throughout the project lifecycle;
- Ensure that fish cages and associated infrastructure are sited in consultation with the BMU and relevant authorities to avoid interference with established fishing grounds, navigation routes, fish landing sites, and community access points;
- Maintain clear access corridors for fishing vessels and other lake users to prevent obstruction of navigation and fishing activities;
- Clearly demarcate project boundaries and operational areas to minimize encroachment and misunderstandings among resource users;

- Prioritize local employment opportunities and procurement of goods and services from surrounding communities where feasible;
- Establish a transparent grievance redress mechanism to address complaints, disputes, and concerns in a timely and equitable manner;
- Conduct regular community awareness programs to provide information on project activities, potential impacts, and mitigation measures;
- Collaborate closely with the local Beach Management Unit and community leadership structures in project planning and decision-making processes;
- Monitor social impacts periodically and implement corrective measures where conflicts or grievances are identified;
- Ensure that project activities do not adversely affect community access to essential natural resources and traditional livelihood activities; and
- Support community development initiatives where feasible as part of the project's corporate social responsibility commitments.

### 7.3.2. Theft and Vandalism

Theft and vandalism are among the key security concerns associated with aquaculture operations, particularly cage culture systems located within or near accessible areas of Lake Victoria. During stakeholder consultations, local fish farmers identified fish theft, unauthorized harvesting, and damage to aquaculture infrastructure as significant risks that can result in substantial economic losses and disruption of farm operations.

The proposed cage culture facilities may be vulnerable to poaching due to their location on the lake, where access by boat is relatively easy. Fish cages, nets, mooring systems, feeding equipment, and other farm infrastructure may also be subject to vandalism, deliberate damage, or theft. Such incidents can lead to fish escapes, reduced production, increased operational costs, and conflicts between resource users. The risk may be heightened during periods of low surveillance, adverse weather conditions, or where community awareness and ownership of the project are limited. Consequently, effective security measures will be essential to safeguard project assets and ensure sustainable operations.

**Mitigation Measures**

- Install appropriate security infrastructure at the land-based facilities, including perimeter fencing, security lighting, and controlled access points;
- Employ trained security personnel to conduct routine surveillance and patrols at both the shore-based and lake-based project facilities;
- Collaborate with the local Beach Management Unit (BMU), community leaders, and relevant security agencies to enhance surveillance and security monitoring;
- Utilize patrol boats for regular inspection and monitoring of cage sites, particularly during night-time and other high-risk periods;
- Install reflective markers, warning signs, and identification tags on cages and associated infrastructure to enhance visibility and ownership recognition;
- Implement access control procedures for authorized personnel, visitors, and contractors;
- Maintain accurate inventory records of fish stocks, equipment, and materials to facilitate accountability and early detection of losses;

- Promote community participation and awareness to foster local ownership and support for the project, thereby reducing the likelihood of vandalism and theft;
- Establish a reporting and response mechanism for security incidents, including clear communication channels with local authorities and law enforcement agencies;
- Conduct regular inspection and maintenance of cages, nets, mooring systems, and other infrastructure to identify and promptly repair any damage;
- Consider the use of modern security technologies such as GPS tracking, surveillance cameras at landing sites, alarm systems, and remote monitoring devices where feasible; and
- Ensure that all security personnel are trained in conflict management, emergency response, and community relations to promote peaceful and effective security operations.

## 8. ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN (ESMP)

### 8.1. Brief Overview

The purpose of the Environmental and Social Management and Monitoring Plan (ESMMP) is to ensure that the social and environmental impacts and risks identified during the ESIA process are effectively managed throughout the construction, operation, and decommissioning phases of the Project. The ESMP outlines the mitigation and management measures to which the proponent is committed, and it demonstrates how the Project will allocate organizational capacity and resources to implement these measures.

Furthermore, the ESMMP details the scheduling of mitigation and management activities and ensures that the Project complies with all applicable laws and regulations in Kenya, as well as relevant policies. The key objectives of the ESMMP are to:

- Formalize and disclose the program for environmental and social management; and
- Provide a structured framework for implementing environmental and social management initiatives.

In accordance with recognized best practice principles, the ESMMP prioritizes proactive measures to minimize, and where feasible, prevent adverse environmental and social impacts, while simultaneously enhancing positive outcomes. These principles have underpinned the development and execution of the ESIA process, ensuring a systematic and evidence-based approach to impact management. The ESMMP provides detailed information on the management and mitigation measures that will be implemented to address potential impacts during the following phases of the Project:

- Pre-construction and construction activities;
- Operation; and
- Decommissioning

### 8.2. Environmental and Social Management Plan (ESMP)

This section outlines the potential adverse impacts, mitigation measures, monitoring and management responsibilities during construction and operation phases of the proposed project. The purpose of ESMP is to:

- Provide an institutional mechanism with well-defined roles and responsibilities for ensuring that measures identified in ESIA designated to mitigation potentially adverse impacts are implemented.
- List all suggested mitigation measures and control technologies, safeguards identified through the ESIA process.
- Provide Project monitoring program for effective implementation of the mitigation measures and ascertain efficacy of the environmental management and risk control systems in place; and
- Assist in ensuring compliance with all relevant legislations at local, County and national level for the Project.

### 8.3. Monitoring

To implement the ESMP, the on-site team will adhere to a time-bound and action oriented Environmental and Social Action Plan to implement the mitigation measures provided for each of the identified environmental and social impacts. This ESMP will be monitored on a regular basis, quarterly or half-yearly, and all outcomes would need to be audited in accordance with existing EHS and NEMA environmental policies. The monitoring process will cover all stakeholders including contractors, laborers, supplier, and local community impacted by the proposed project activities and associated facilities thereby increasing the effectiveness of suggested mitigations measures.

### 8.4. Organizations and Their Responsibilities for ESMP Implementation

The implementation of the ESMP will involve coordinated participation from multiple stakeholders, each with defined roles and responsibilities. Key stakeholders will include, among others, the Aquaculture farm operator (Proponent), whose primary responsibility will be to ensure compliance with all operational, environmental, and social safeguards outlined in the ESMP. Amongst the key stakeholders shall include but not limited.

a) National Environment Management Authority (NEMA)
b) State Department of Fisheries & Blue Economy (SDF&BE),
c) County Government of Homa-Bay
d) Kenya Fisheries Services (KeFS)
e) Community Representatives / Beach Management Units (BMUs)
f) Kenya Maritime Authority (KMA)
g) Non-Governmental Organizations (NGOs) and Civil Society, and
h) Project affected person's (Local communities)

*Table 4: Environmental and Social Management Plan (ESMP)*

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| **Construction Phase** | | | | |
| *7.1.1 Disturbance of Lakebed & Aquatic Habitats* | • Conduct pre-installation surveys to identify suitable cage locations and avoid ecologically sensitive habitats and fish breeding areas;<br>• Use environmentally appropriate anchoring systems designed to minimize lakebed disturbance;<br>• Restrict anchoring and installation activities to designated project areas;<br>• Minimize the movement of installation vessels and equipment within sensitive aquatic habitat;<br>• Inspect and maintain mooring systems regularly to prevent anchor dragging and unnecessary disturbance of the lakebed; and<br>• Restore any disturbed areas where feasible following installation activities | • Survey reports completed<br>• Number/location of sensitive habitats avoided<br>• Anchor drag incidents (target: 0) | Project Environmental Officer / Contractor / KeFS | Pre-construction survey; weekly during installation |
| *7.1.2 Increased Water Turbidity & Sedimentation* | • Install erosion and sediment control measures around construction areas;<br>• Minimize in-water construction activities during periods of heavy rainfall and strong wave action;<br>• Implement shoreline stabilization measures where necessary;<br>• Monitor turbidity levels during major construction activities; and<br>• Rehabilitate disturbed areas immediately after construction | • Turbidity levels (NTU)<br>• Visible sediment plumes<br>• Erosion control structures in place | Contractor / Environmental Officer | Daily during earthworks; weekly reports |
| *7.1.3 Land Disturbance & Soil Degradation* | • Limit site clearance, excavation, and vegetation removal strictly to designated construction areas to minimize unnecessary land disturbance.<br>• Clearly demarcate construction boundaries before commencement of works to prevent encroachment into adjacent areas and sensitive habitats.<br>• Stockpile topsoil separately from subsoil and reuse it during site rehabilitation, landscaping, and revegetation activities following construction.<br>• Implement erosion and sediment control measures such as earth bunds, silt traps, sediment retention | • Area cleared vs approved (ha)<br>• Topsoil stockpiles protected<br>• Erosion features observed (gullies/rills)<br>• % of disturbed area restored | Contractor / Site Supervisor / Environmental Officer | Weekly inspections; post-rainfall |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | ponds, diversion channels, and contour drains to reduce soil loss and sediment transport.<br>• Schedule major earthworks and excavation activities during dry weather periods, where practicable, to minimize erosion and runoff.<br>• Stabilize exposed soils as soon as possible through compaction, mulching, grassing, or revegetation to prevent erosion.<br>• Minimize the duration for which excavated surfaces and stockpiles remain exposed to wind and water erosion.<br>• Protect drainage channels, streams, and lake shorelines from sediment-laden runoff through the installation of appropriate barriers and buffer zones.<br>• Restrict movement of heavy machinery and vehicles to designated access routes to reduce soil compaction and land degradation.<br>• Regularly inspect construction areas, especially after heavy rainfall events, and promptly repair any erosion features such as gullies, rills, or slope failures.<br>• Properly manage excavated materials and spoil to prevent uncontrolled deposition and sedimentation of nearby water bodies.<br>• Restore disturbed areas immediately upon completion of construction works through grading, topsoil replacement, and revegetation using suitable indigenous plant species | | | |
| *7.1.4 Water Resources Use & Pollution Risk* | • Obtain all necessary water abstraction permits and approvals from the relevant regulatory authorities before commencement of construction activities.<br>• Use water efficiently through the adoption of water conservation measures and avoid unnecessary abstraction from surface water or groundwater sources.<br>• Regularly inspect water supply systems to identify and repair leaks, thereby minimizing water losses. | • Water abstraction volumes vs permits<br>• Spill incidents (target: 0)<br>• Water quality parameters (pH, turbidity, oils) | Contractor / Environmental Officer | Monthly water quality sampling; daily visual checks |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | • Prioritize the use of harvested rainwater and recycled water for activities such as dust suppression and equipment cleaning where feasible.<br>• Prevent the discharge of untreated runoff, wastewater, or contaminated water into rivers, streams, wetlands, Lake Victoria, or other natural watercourses.<br>• Construct appropriate drainage systems to manage stormwater runoff and prevent erosion, flooding, and sediment transport from construction areas.<br>• Install sediment control measures such as silt traps, sedimentation ponds, and drainage channels to reduce the movement of suspended solids into nearby water bodies.<br>• Store fuels, oils, lubricants, paints, cement, and other chemicals in designated, secure, and bunded storage areas away from watercourses and drainage pathways.<br>• Refuel and service construction equipment only in designated areas equipped with spill containment measures.<br>• Maintain spill response kits at strategic locations and ensure personnel are trained in spill prevention, containment, and clean-up procedures.<br>• Immediately contain and remediate any fuel, oil, or chemical spills to prevent contamination of soil and water resources.<br>• Prohibit the washing of vehicles, machinery, or equipment directly within or near natural water bodies.<br>• Provide adequate sanitation facilities for construction workers and ensure wastewater is managed and disposed of appropriately.<br>• Regularly monitor water quality in nearby water bodies where construction activities may pose a contamination risk | | | |
| *7.1.5 Generation of Solid & Liquid Waste* | • Develop and implement a site-specific Waste Management Plan outlining procedures for waste | • Waste volumes by category (kg)<br>• % recycled/reused | Contractor / Waste Management Officer | Weekly waste audits; monthly reports |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | minimization, segregation, collection, storage, transportation, recycling, and disposal.<br>• Segregate waste at source into recyclable, reusable, biodegradable, hazardous, and non-recyclable categories using clearly labelled and colour-coded waste receptacles.<br>• Provide adequate waste collection bins at strategic locations throughout the construction site and ensure regular emptying to prevent overflow and littering.<br>• Reuse excavated materials, construction debris, and other suitable materials wherever feasible to minimize waste generation.<br>• Promote recycling of materials such as paper, cardboard, plastics, metals, glass, and packaging materials through licensed recycling service providers.<br>• Dispose of non-recyclable waste only through licensed waste handlers and at approved disposal facilities in accordance with applicable environmental regulations.<br>• Establish designated waste storage areas that are secure, well maintained, and protected from wind, rainfall, and scavenging animals.<br>• Ensure hazardous wastes such as used oils, lubricants, paint residues, chemical containers, batteries, and contaminated materials are stored, handled, transported, and disposed of separately in accordance with legal requirements.<br>• Prohibit open dumping, open burning, and disposal of waste into water bodies, wetlands, drainage channels, or other environmentally sensitive areas.<br>• Provide adequate sanitation facilities for construction workers and ensure proper collection, treatment, and disposal of sewage and wastewater.<br>• Implement good housekeeping practices to maintain a clean and orderly construction site at all times.<br>• Conduct regular inspections of waste storage and disposal areas to identify and address potential environmental risks. | • Licensed disposal records - Waste storage condition | | |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | • Train workers on proper waste handling, segregation, storage, and disposal procedures.<br>• Maintain records of waste generation, recycling, transportation, and disposal to facilitate monitoring and regulatory compliance.<br>• Engage licensed waste management service providers for the collection, transportation, treatment, and disposal of waste generated during construction | | | |
| *7.1.6 Air Quality & Noise Pollution* | • Regularly sprinkle water on exposed soils, access roads, excavation areas, and other dusty surfaces to suppress dust generation, particularly during dry and windy conditions.<br>• Cover trucks transporting soil, sand, gravel, and other loose materials to prevent dust emissions during transportation.<br>• Limit vehicle speeds within the construction site and along access roads to reduce dust generation.<br>• Maintain construction equipment, machinery, generators, and vehicles in good working condition through regular servicing and maintenance to minimize exhaust emissions and excessive noise.<br>• Avoid unnecessary idling of vehicles and machinery when not in use to reduce fuel consumption, air emissions, and noise levels.<br>• Use modern, fuel-efficient, and low-emission equipment wherever feasible.<br>• Stockpile construction materials in designated areas and cover fine materials that are susceptible to wind dispersal.<br>• Restrict construction activities to normal daytime working hours to minimize noise disturbance to nearby residents, institutions, and other sensitive receptors.<br>• Schedule particularly noisy activities during periods least likely to affect surrounding communities.<br>• Install silencers, mufflers, and noise suppression devices on generators, compressors, and heavy machinery where appropriate. | • Dust levels ($PM_{10}$)<br>• Noise levels (dB) at boundaries<br>• Complaints received<br>• Equipment maintenance logs | Contractor / Environmental Officer | Daily during dusty activities; weekly noise monitoring |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | • Position stationary noise-generating equipment away from residential areas and other sensitive receptors whenever practicable.<br>• Establish temporary noise barriers or acoustic screens around high-noise construction activities where necessary.<br>• Provide workers with appropriate PPE, including dust masks, respirators, ear plugs, and ear muffs, depending on the nature of their work and exposure levels.<br>• Conduct regular monitoring of dust levels, air quality, and noise levels to ensure compliance with applicable environmental and occupational health standards | | | |
| *7.1.7 Occupational Health & Safety Risks* | • Comply with the provisions of the Occupational Safety and Health Act (OSHA), 2007, and all other applicable occupational health and safety regulations.<br>• Develop and implement a site-specific Occupational Health and Safety (OHS) Management Plan for all construction activities.<br>• Conduct comprehensive safety induction and awareness training for all workers before commencement of work and provide regular refresher training throughout the construction period.<br>• Undertake task-specific training for workers involved in specialized activities such as excavation, electrical works, operation of heavy machinery, welding, working at heights, and in-water construction activities.<br>• Provide appropriate PPE including safety helmets, safety boots, gloves, high-visibility vests, hearing protection, eye protection, respiratory masks, and life jackets for personnel working on or near water.<br>• Enforce the proper use, maintenance, and replacement of PPE at all times while on site.<br>• Install adequate warning signs, safety notices, barriers, and restricted access controls around hazardous work areas. | • Training attendance records<br>• Incident/near-miss reports (target: reduce over time)<br>• PPE compliance rate | Contractor / OHS Officer | Daily toolbox talks; monthly OHS reports |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | • Ensure that all machinery, tools, and equipment are regularly inspected, maintained, and operated only by trained and authorized personnel.<br>• Conduct routine risk assessments and job hazard analyses to identify potential hazards and implement appropriate control measures.<br>• Provide and maintain fully stocked first-aid kits at strategic locations throughout the site and ensure that trained first-aiders are available during all working hours.<br>• Establish emergency preparedness and response procedures covering accidents, injuries, fires, drowning incidents, equipment failure, chemical spills, and extreme weather events.<br>• Provide emergency communication equipment and maintain readily accessible emergency contact information for medical facilities, emergency services, and project management personnel.<br>• Develop and implement fire prevention and response measures, including provision of suitable fire extinguishers, staff training, and periodic fire drills.<br>• Ensure safe storage, handling, and transportation of fuels, chemicals, and hazardous substances in designated areas | | | |
| *7.1.8 Socio-Economic Impacts & Community Interaction* | • Prioritize recruitment of qualified local labour and procurement of locally available goods and services where feasible to enhance local economic benefits and community support for the project.<br>• Implement a transparent and non-discriminatory recruitment process that provides equal employment opportunities regardless of gender, age, disability, ethnicity, or social status.<br>• Sensitize all workers and contractors on community relations, local customs, cultural values, and acceptable conduct within the host communities.<br>• Develop and enforce a Workers' Code of Conduct outlining expected behaviour, respect for local | • % local workforce<br>• Number of grievances received & resolved<br>• Community meeting attendance - Reported conflicts/incidents | Community Liaison Officer / Project Manager | Monthly GRM reports; quarterly stakeholder meetings |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | traditions, prohibition of harassment, discrimination, and other forms of misconduct.<br>• Establish and maintain an accessible, transparent, and effective Grievance Redress Mechanism (GRM) to receive, document, investigate, and resolve community complaints and concerns in a timely manner.<br>• Conduct regular stakeholder engagement and consultation meetings with local communities, community leaders, Beach Management Units (BMUs), and other relevant stakeholders throughout the construction period.<br>• Ensure compliance with all applicable labour laws, occupational health and safety regulations, and international labour standards regarding wages, working hours, leave, non-discrimination, and workers' welfare.<br>• Provide fair terms and conditions of employment, including written contracts, timely payment of wages, and access to grievance procedures for workers.<br>• Implement awareness programs on HIV/AIDS, sexually transmitted infections (STIs), gender-based violence (GBV), sexual exploitation and abuse (SEA), substance abuse, and communicable disease prevention.<br>• Prohibit child labour, forced labour, and all forms of exploitation in accordance with national legislation and international labour standards | | | |

*Table 5: ESMP Operation Phase*

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| **Operation Phase** | | | | |
| *7.3.1 Diseases & Parasites* | • Aquaculture farmers must be aware of the impacts that fish disease could have and must manage units so as to prevent infection, whilst being able to deal with any outbreaks effectively if they occur;<br>• No aquaculture organisms may be imported into the aquaculture production facility from unrecognised sources, and all imported ova and fingerlings need to be certified disease free by the supplier;<br>• It is required to have all stock checked and certified as disease free prior to introducing such organisms into the production facility;<br>• Treatment of diseases must be done by recognised methods and under the guidance of recognised aquaculture pathologists. All treatments must be recorded; and<br>• The storage and use of aquaculture chemicals and medications must be done in a safe and responsible manner as per the relevant Material Safety Data Sheet (MSDS).<br>• If greater numbers die (more than 0.1% of the stock) or if the associated behaviour of the organisms indicates a problem, the first step is to monitor the physical and chemical characteristics of the water (temperature, pH, oxygen content, etc.). Failing the detection of any adverse water conditions a recognised pathologist should be approached to determine the cause;<br>• Dead aquatic organisms must be removed from the production systems as soon as they are detected. If samples are required for diagnostic purposes, these must be taken and appropriately stored for this purpose | • Mortality rate (<0.1% threshold)<br>• Disease outbreak incidents<br>• Water quality parameters<br>• Treatment records | Farm Manager / Aquaculture Veterinarian / KeFS | Daily stock observation; monthly health checks |
| *7.3.2 Water Quality (Pollution)* | • Regularly monitor key water quality parameters, including dissolved oxygen, temperature, pH, turbidity, Secchi depth, nutrients (nitrogen and phosphorus), chlorophyll-a, algal cell counts and species composition, ammonia, nitrite, nitrate, biochemical oxygen demand (BOD), and total suspended solids (TSS). | • DO, pH, NH3, NO2, TP, TN, TSS, Chl-a levels - Secchi depth<br>• Effluent compliance with standards | Environmental Officer / Farm Manager | Weekly (or as per permit); quarterly comprehensive reports |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | • Implement a comprehensive water quality monitoring program with clearly defined sampling locations, frequencies, and reporting procedures.<br>• Optimize feeding practices to minimize feed wastage and nutrient loading by using high-quality feeds, appropriate feeding rates, and efficient feeding techniques.<br>• Conduct routine inspection and maintenance of cages, ponds, water intake systems, and drainage structures to prevent water contamination and ensure efficient water circulation.<br>• Avoid overstocking of fish to maintain carrying capacity limits and reduce excessive organic matter accumulation.<br>• Install aeration systems where necessary to maintain adequate dissolved oxygen levels and improve water circulation.<br>• Remove accumulated sludge, sediment, and organic debris from ponds and settling facilities on a regular basis to prevent nutrient buildup and deterioration of water quality;<br>• Ensure proper treatment of pond effluent through sedimentation ponds, constructed wetlands, or other suitable treatment systems before discharge into the environment;<br>• Implement biosecurity measures to prevent disease outbreaks that could necessitate excessive use of chemicals or antibiotics.<br>• Restrict the use of chemicals, disinfectants, and veterinary products to approved substances and apply them strictly according to manufacturer recommendations and regulatory requirements.<br>• Develop and implement an emergency response plan to address incidents such as fish mortality events, algal blooms, chemical spills, and water quality deterioration;<br>• Monitor upstream and downstream water quality to assess the project's influence on receiving water bodies and facilitate adaptive management; | | | |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | • Conduct periodic environmental audits and water quality assessments to evaluate the effectiveness of mitigation measures and identify areas for improvement; and<br>• Maintain records of water quality monitoring results and use the data to guide adaptive management decisions aimed at sustaining optimal fish health and environmental quality | | | |
| *7.3.3 Air Emissions* | • Install dust control measures in feed milling and processing areas, including enclosed processing equipment, dust extraction systems, and adequate ventilation;<br>• Regularly clean feed storage, processing, and handling areas to prevent the accumulation and dispersal of dust;<br>• Store feed ingredients and finished products in enclosed structures or covered containers to minimize fugitive dust emissions;<br>• Maintain all generators, vehicles, and machinery in accordance with manufacturer specifications to ensure efficient combustion and reduced emissions;<br>• Use energy-efficient equipment and adopt preventive maintenance schedules to minimize fuel consumption and exhaust emissions;<br>• Where feasible, utilize cleaner energy sources or grid electricity to reduce reliance on diesel-powered generators;<br>• Implement proper waste management practices and promptly remove fish mortalities to prevent the generation of offensive odours;<br>• Maintain good housekeeping practices throughout the facility to minimize dust and odour emissions;<br>• Establish vegetative buffers around operational areas where feasible to help trap dust and improve local air quality;<br>• Provide workers with appropriate PPE, including dust masks and respirators where necessary;<br>• Conduct periodic air quality and occupational health monitoring, particularly in feed milling and processing areas; and | • Dust levels in processing areas<br>• Generator emission records<br>• Complaints | Facility Manager / Environmental Officer | Monthly monitoring |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | • Ensure compliance with applicable national environmental, occupational health, and air quality regulations | | | |
| *7.3.4 Habitat Degradation* | • Site cages, ponds, and associated infrastructure away from ecologically sensitive habitats, breeding grounds, wetlands, and areas of high biodiversity value;<br>• Minimize vegetation clearance and land disturbance during construction and operation activities;<br>• Implement proper feed management practices to reduce feed wastage and nutrient accumulation in the aquatic environment;<br>• Maintain optimal stocking densities to minimize organic loading and environmental stress;<br>• Conduct regular monitoring of sediment quality, benthic conditions, and aquatic biodiversity around cage sites;<br>• Rotate cage locations, where feasible, to allow for natural recovery of affected benthic habitats;<br>• Establish vegetative buffer zones around land-based facilities to reduce erosion, sedimentation, and surface runoff;<br>• Properly manage solid waste, wastewater, and fish mortalities to prevent environmental contamination;<br>• Develop and implement spill prevention and response procedures for fuels, oils, and chemicals;<br>• Restore disturbed areas through revegetation and habitat rehabilitation measures following construction activities;<br>• Monitor water quality parameters regularly and implement corrective measures where deterioration is detected;<br>• Comply with environmental management requirements established by relevant regulatory authorities and implement recommendations from environmental monitoring programs; and<br>• Conduct periodic environmental audits to assess the effectiveness of habitat protection measures and identify opportunities for improvement | • Benthic/sediment quality<br>• Biodiversity indices around sites<br>• Vegetation cover in buffers | Environmental Officer | Quarterly monitoring |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| *7.3.5 Risks to Indigenous Fish Species* | • Source broodstock, fry, and fingerlings only from certified hatcheries approved by the Kenya Fisheries Service (KeFS);<br>• Comply with all applicable fisheries, aquaculture, and biosecurity regulations governing fish movement and stocking;<br>• Implement strict biosecurity measures to prevent the introduction and spread of fish diseases and parasites;<br>• Conduct regular fish health monitoring and disease surveillance in accordance with approved fish health management protocols;<br>• Minimize fish escape incidents through the use of robust cage designs, secure pond embankments, predator-resistant netting, and routine infrastructure inspections;<br>• Maintain appropriate stocking densities to reduce fish stress and susceptibility to disease outbreaks;<br>• Quarantine new fish stocks before introduction into existing production systems;<br>• Use only approved chemicals, disinfectants, and veterinary products in accordance with manufacturer instructions and regulatory requirements;<br>• Prohibit the discharge of untreated wastewater containing chemicals, medications, or other contaminants into natural water bodies;<br>• Establish effluent treatment and water quality management systems to prevent contamination of the surrounding aquatic environment;<br>• Maintain detailed records of fish movements, health status, treatments administered, and mortality events;<br>• Promptly report unusual disease outbreaks or mass fish mortality events to the Kenya Fisheries Service and other relevant authorities;<br>• Undertake periodic environmental monitoring to assess potential impacts on wild fish populations and aquatic biodiversity; and<br>• Train farm personnel on biosecurity, disease prevention, fish health management, and environmental protection measures | • Escape incidents (target: 0)<br>• Genetic monitoring (where applicable)<br>• Disease reports to KeFS | Farm Manager / KeFS | Ongoing; report incidents immediately |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| *7.3.6 Potential Fish Escapees* | • Install screens on all inlet and outlet points in the fish farm to minimize the escape of fry, juveniles and broodstock;<br>• Filter screens in fish farms shall be designed to retain the smallest life stage present;<br>• Cages should be made of sturdy, non-corrosive materials;<br>• Make thorough inspection of nets before they are deployed so as to avoid possible escapees from the cages;<br>• Follow protocols when transferring, changing nets or harvesting fish from the cages e.g. use<br>• of fish boxes;<br>• Divers or underwater cameras must periodically inspect cages for holes, rips and tears;<br>• No production stock may be kept in settlement and filtration ponds or any other unit not specifically designated as part of the production cycle;<br>• The moving of fish (cage stocking, grading and harvesting) must be done in a manner, which prevents escape; and<br>• During the inspection of fish a 'catch net' must be placed between the working platform where the fish are being handled and the open water. This must ensure that any fish that mistakably fall on the working deck must not escape | • Net/cage integrity checks<br>• Escape incidents | Cage Operations Supervisor | Weekly net inspections; immediate reporting |
| *7.3.7 Cage Structure Failure* | • The cage anchor lines must be regularly (once a month) inspected to ensure the stable positioning and anchoring of the cage system at all times;<br>• Cage platforms must be kept in good order (clean, tidy and free of unnecessary equipment etc.);<br>• Cage netting must be kept clean, free of algal growth and free of any damage or holes that could lead to fish escape or the penetration of predators;<br>• No chemicals may be used in the cleaning of the cage nets unless approval is obtained from the relevant authorities; | • Inspection records<br>• Structural integrity reports<br>• Failure incidents | Cage Operations Supervisor | Monthly (anchors); weekly visual |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | • The HDPE piping of floating cage collars must be checked for corrosion and leaks so that these can be repaired or replaced if necessary; and<br>• The cage units may be moved from time to time to lessen the localised build-up of organic sediments directly underneath the cage facilities. These positions must remain within the areas zoned/approved for the operation of the cage culture system | | | |
| *7.3.8 Chemical Spills & Incorrect Application* | • The use of chemicals must be done in a responsible manner and operators must ensure that no downstream environmental impacts emanate from such chemical use;<br>• Chemicals must be used for specific and not general purposes;<br>• The handler must wear appropriate PPE;<br>• Dosages, application methods and resultant outcome must be known and recorded in a treatment register;<br>• Chemicals must be stored in a dry, well-ventilated and lockable chemical store;<br>• Chemical purchase dates, use and expiry dates must be recorded;<br>• Expired chemicals must be disposed of at a suitable hazardous waste disposal site;<br>• The advice of a recognised fish pathologists or aquaculturists must be sought where the application of chemicals is uncertain | • Chemical inventory & expiry tracking<br>• Spill incidents (target: 0)<br>• Treatment register | Farm Manager / Chemical Handler | Continuous; audit quarterly |
| *7.3.9 Endangering Predators* | • Bird netting must be positioned so as not to hinder the natural movement of the birds. They should be visible to the birds;<br>• No traps may be used to injure any predators of aquaculture organisms. Traps may only be set if these predators can be caught live (without injury) for translocation to alternative areas. This may only be done under the supervision of recognised organisations or authorities;<br>• No poisons may be left out for aquaculture predators;<br>• No animals that prey on the aquaculture species may be shot;<br>• The main aquaculture predators and their control methods include cover netting for birds (Cormorants, | • Predator interaction incidents<br>• Netting effectiveness | Farm Manager | Ongoing observation |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | Kingfishers, Fish Eagles, Herons, Storks and others) and fencing and netting for otters | | | |
| *7.3.10 Pond Effluent* | • The introduction of the hapa system will minimize nutrient loading from pond drainage by reducing the need for frequent pond emptying and water exchange;<br>• Minimize effluent discharge by reducing the frequency of pond draining and adopting water conservation practices wherever feasible;<br>• Establish settling ponds to retain effluent for at least 48 hours, allowing suspended solids to settle and promoting the breakdown and hydrolysis of organic matter before discharge;<br>• Utilize the natural activity of anaerobic bacteria within settling ponds to facilitate the decomposition and stabilization of organic matter;<br>• Ensure that water intake and effluent discharge points are located separately and operate independently to prevent cross-contamination between incoming water supplies and discharged effluent; and<br>• Regularly monitor effluent quality and maintain treatment facilities to ensure compliance with applicable environmental standards and regulatory requirements | • Effluent quality parameters before discharge<br>• Settling pond performance | Pond Operations Supervisor | Before each discharge; monthly |
| *7.3.11 General Waste* | • Develop and implement an Integrated Waste Management Plan for the project;<br>• Segregate waste at source into recyclable, organic, hazardous, and non-recyclable categories using clearly labelled and colour-coded waste bins;<br>• Provide adequate waste collection bins at strategic locations throughout the facility;<br>• Ensure regular collection and disposal of waste to prevent accumulation and littering;<br>• Reuse and recycle materials such as plastics, paper, cardboard, metal, and packaging materials wherever feasible;<br>• Engage licensed and authorized waste handlers for transportation and disposal of non-recyclable wastes at approved disposal facilities; | • Waste volumes & recycling rates<br>• Site cleanliness audits | Waste Management Officer | Weekly |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | • Compost biodegradable and organic waste where practical and environmentally appropriate.<br>• Prohibit open dumping, open burning, and disposal of waste into water bodies, wetlands, or drainage channels;<br>• Conduct regular housekeeping and site-cleaning activities to maintain cleanliness and prevent waste accumulation;<br>• Train workers on proper waste segregation, handling, storage, and disposal procedures;<br>• Establish designated waste storage areas that are secure, well maintained, and protected from wind, rainfall, and animal scavenging;<br>• Undertake routine inspections and audits of waste management practices to ensure compliance with environmental regulations and project requirements;<br>• Promote waste minimization through efficient procurement, material handling, and resource-use practices; and<br>• Maintain records of waste generation, recycling, transportation, and disposal to facilitate monitoring and continuous improvement | | | |
| *7.3.12 Ice Processing Plant* | • Install water-efficient ice-making equipment and implement water conservation measures;<br>• Collect and properly manage wastewater from cleaning and operational activities before discharge;<br>• Conduct regular inspection and maintenance of refrigeration systems to prevent refrigerant leaks;<br>• Use environmentally friendly refrigerants with low ozone depletion and global warming potential where feasible;<br>• Install noise control measures, including equipment enclosures, silencers, and routine maintenance of machinery;<br>• Provide adequate drainage systems to prevent water stagnation and localized flooding;<br>• Implement good housekeeping practices and regular cleaning schedules; | • Water & energy consumption<br>• Wastewater quality<br>• Refrigerant leak checks | Ice Plant Operator | Monthly |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | • Segregate and properly dispose of solid waste generated from operations and maintenance activities;<br>• Train personnel on equipment operation, emergency response procedures, and environmental management practices;<br>• Monitor water consumption, energy use, and wastewater quality to improve operational efficiency and environmental performance; and<br>• Ensure compliance with applicable environmental, occupational health, and safety regulations | | | |
| *7.3.13 Fish Health & 7.3.14 Biosecurity* | • Develop and implement a comprehensive Biosecurity Management Plan covering all hatchery, nursery, pond, cage, and fish handling operations;<br>• Ensure compliance with all applicable fisheries, veterinary, and aquaculture regulations, including guidelines issued by the Kenya Fisheries Service (KeFS);<br>• Restrict access to production areas through controlled entry points and maintain visitor logs for all personnel entering the facility;<br>• Establish quarantine procedures for all newly acquired broodstock, fry, fingerlings, and other aquatic organisms before introduction into production systems;<br>• Source broodstock, fry, fingerlings, and fish feed only from certified and reputable suppliers with documented health records;<br>• Conduct routine fish health surveillance and inspections to identify early signs of disease, stress, injury, or abnormal behaviour;<br>• Regularly monitor and maintain optimal water quality parameters, including dissolved oxygen, temperature, pH, ammonia, nitrite, and turbidity;<br>• Clean and disinfect equipment, nets, cages, tanks, vehicles, and other farm infrastructure before and after use to prevent disease transmission;<br>• Install footbaths, handwashing stations, and disinfection points at strategic locations within the facility;<br>• Prohibit the sharing of equipment between production units unless properly cleaned and disinfected; | • Compliance with KeFS requirements<br>• Biosecurity audit scores<br>• Disease incidence | Farm Manager / Veterinarian | Daily; quarterly audits |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | • Implement strict protocols for handling, transport, stocking, grading, and harvesting fish to minimize stress and reduce disease susceptibility;<br>• Promptly remove and safely dispose of dead, diseased, or moribund fish through approved methods to prevent pathogen proliferation.<br>• Control predators, pests, and vectors such as birds, rodents, insects, and other animals that may transmit diseases between production units;<br>• Maintain appropriate stocking densities in accordance with species requirements and the carrying capacity of the culture system;<br>• Use vaccines, probiotics, immunostimulants, and approved fish health products where appropriate and under professional guidance;<br>• Minimize unnecessary use of antibiotics and other therapeutants, ensuring that any treatments comply with regulatory requirements and best aquaculture practices;<br>• Maintain detailed records of fish health monitoring, mortalities, treatments, disease incidents, water quality data, and biosecurity inspections;<br>• Train all farm personnel on biosecurity procedures, disease recognition, hygiene requirements, and emergency response protocols;<br>• Establish contingency and emergency response procedures for disease outbreaks, including isolation of affected units and notification of relevant authorities; and<br>• Conduct regular biosecurity audits and reviews to evaluate the effectiveness of control measures and implement corrective actions where necessary. | | | |

*Table 6: ESMP Social Risks*

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency |
|---|---|---|---|---|
| *7.4.1 User Conflicts* | • Obtain all relevant permits, licenses, and approvals from the relevant government agencies before project implementation; | • Grievances related to access<br>• Stakeholder meeting records | Community Liaison Officer / Project Manager | Continuous; monthly GRM summary |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency |
|---|---|---|---|---|
| | • Undertake continuous stakeholder engagement and consultation with local communities, fishermen, fish traders, Beach Management Units (BMUs), county government representatives, and other resource users throughout the project lifecycle;<br>• Ensure that fish cages and associated infrastructure are sited in consultation with the BMU and relevant authorities to avoid interference with established fishing grounds, navigation routes, fish landing sites, and community access points;<br>• Maintain clear access corridors for fishing vessels and other lake users to prevent obstruction of navigation and fishing activities;<br>• Clearly demarcate project boundaries and operational areas to minimize encroachment and misunderstandings among resource users;<br>• Prioritize local employment opportunities and procurement of goods and services from surrounding communities where feasible;<br>• Establish a transparent grievance redress mechanism to address complaints, disputes, and concerns in a timely and equitable manner;<br>• Conduct regular community awareness programs to provide information on project activities, potential impacts, and mitigation measures;<br>• Collaborate closely with the local Beach Management Unit and community leadership structures in project planning and decision-making processes;<br>• Monitor social impacts periodically and implement corrective measures where conflicts or grievances are identified;<br>• Ensure that project activities do not adversely affect community access to essential natural resources and traditional livelihood activities; and<br>• Support community development initiatives where feasible as part of the project's corporate social responsibility commitments. | • BMU collaboration level | | |
| *7.4.2 Theft & Vandalism* | • Install appropriate security infrastructure at the land-based facilities, including perimeter fencing, security lighting, and controlled access points; | • Security incidents (theft/vandalism)<br>• Patrol logs<br>• Community awareness sessions | Security Manager / Farm Manager | Daily logs; monthly reports |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency |
|---|---|---|---|---|
| | • Employ trained security personnel to conduct routine surveillance and patrols at both the shore-based and lake-based project facilities;<br>• Collaborate with the local Beach Management Unit (BMU), community leaders, and relevant security agencies to enhance surveillance and security monitoring;<br>• Utilize patrol boats for regular inspection and monitoring of cage sites, particularly during night-time and other high-risk periods;<br>• Install reflective markers, warning signs, and identification tags on cages and associated infrastructure to enhance visibility and ownership recognition;<br>• Implement access control procedures for authorized personnel, visitors, and contractors;<br>• Maintain accurate inventory records of fish stocks, equipment, and materials to facilitate accountability and early detection of losses;<br>• Promote community participation and awareness to foster local ownership and support for the project, thereby reducing the likelihood of vandalism and theft;<br>• Establish a reporting and response mechanism for security incidents, including clear communication channels with local authorities and law enforcement agencies;<br>• Consider the use of modern security technologies such as GPS tracking, surveillance cameras at landing sites, alarm systems, and remote monitoring devices where feasible; and<br>• Ensure that all security personnel are trained in conflict management, emergency response, and community relations to promote peaceful and effective security operations | | | |

## 8.5. Decommissioning Phase

Decommissioning of the integrated aquaculture project at Tabla Beach will involve the systematic removal of all project infrastructure, restoration of the site to pre-project or agreed land-use conditions, and management of associated environmental and social impacts. This phase is critical to ensure that residual impacts from construction and operation are addressed, long-term environmental liabilities are minimized, and the site is returned to a safe, stable, and ecologically functional state. Decommissioning activities may include removal of lake-based cages, anchors, moorings and platforms; demolition or dismantling of land-based facilities (ponds, hatchery, feed mill, ice processing plant, buildings, and associated infrastructure); waste management; soil and habitat restoration; and management of socio-economic transitions. Without proper planning, decommissioning could result in temporary disturbance to aquatic and terrestrial habitats, generation of significant waste streams, potential contamination, and adverse effects on local livelihoods.

A detailed Decommissioning Plan shall be prepared at least 12 months prior to planned closure (or earlier if triggered by project termination) and submitted for approval by NEMA, KeFS, and other relevant authorities. The plan shall include a schedule, cost estimates, financial assurance mechanisms, stakeholder engagement strategy, and post-closure monitoring program.

### 8.5.1. Infrastructure Removal

Removal of cage structures, anchors, mooring lines, floats, platforms, and associated lake-based infrastructure may disturb lakebed sediments, leading to temporary increases in turbidity, resuspension of nutrients or contaminants, and short-term impacts on benthic communities and aquatic habitats. Incomplete removal of debris could result in long-term navigation hazards or entanglement risks for aquatic species.

*Table 7: Decommissioning Management Plan*

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| *7.5.1 Infrastructure Removal & Lakebed Disturbance (Cages, anchors, moorings, platforms)* | • Develop and implement a detailed, site-specific Decommissioning Plan at least 12 months prior to commencement of decommissioning activities;<br>• Use controlled lifting techniques and divers/underwater support for all lake-based infrastructure removal. Employ cranes on barges or specialized pontoons to lift cages, anchors, mooring lines, floats, and platforms instead of dragging them across the lakebed;<br>• Remove all debris and abandoned materials from the lakebed. Conduct thorough searches to recover lost nets, ropes, broken cage components, mooring weights, and any other project-related debris that could pose navigation hazards or continue to smother habitats;<br>• Conduct pre- and post-decommissioning surveys. Perform comprehensive bathymetric, sediment quality, and benthic habitat surveys before removal to establish baseline conditions and map infrastructure;<br>• Schedule all in-lake removal activities during calm weather windows. Works shall be planned for periods of low wind, minimal wave action, and preferably during the dry season to minimize sediment suspension and turbidity plumes;<br>• Minimize vessel movement and equipment footprint. Restrict the number and movement of support vessels and heavy equipment to designated access corridors to avoid unnecessary disturbance to the lakebed and surrounding aquatic vegetation. | % of structures removed<br><br>Debris incidents (target: 0)<br><br>Bathymetric & benthic survey results | Project Proponent / Specialized Contractor / KeFS / NEMA | Pre-decommissioning survey; daily during removal; post-removal verification report |
| *7.5.2 Land-Based Facility Demolition & Site Clearance (Ponds, hatchery, ice plant, buildings)* | • Remove all foundations, concrete structures, liners, and hard standing. Break down and excavate concrete foundations, pond embankments, hatchery buildings, ice plant, feed mill, and other permanent structures unless specific components are approved for retention or alternative use;<br>• Re-grade the site to natural topography and drainage patterns. Restore the land surface to approximate pre-project contours and natural drainage conditions to prevent erosion, ponding of water, and long-term landscape alteration. | Volume of sludge removed & disposed<br><br>Area re-graded (ha)<br><br>% materials recycled | Contractor / Environmental Officer | Weekly progress reports; final completion report |
| *7.5.3 Waste Generation & Hazardous Materials* | • Segregate waste at source into clearly defined categories. Use colour-coded and labelled receptacles to separate recyclable materials (metals, plastics, concrete, timber), hazardous waste (refrigerants, fuels, oils, chemicals, | Waste volumes by category & % recycled | Waste Management Contractor / | Continuous tracking; final waste audit at closure |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | batteries, contaminated materials), general waste, and biodegradable waste.<br>• Engage licensed waste handlers and recycling service providers. All waste shall be transported, treated, recycled, or disposed of only through NEMA-licensed contractors and at approved facilities in full compliance with national waste management regulations.<br>• Ensure safe handling of refrigerants, fuels, oils, and chemicals. Recover refrigerants from the ice processing plant by certified technicians using appropriate recovery equipment to prevent release of ozone-depleting substances or greenhouse gases. | Hazardous waste manifests<br><br>No uncontrolled dumping | Environmental Officer | |
| *7.5.4 Soil Contamination, Erosion & Land Degradation* | • Conduct comprehensive soil and sediment testing. Perform pre-decommissioning and post-decommissioning sampling and laboratory analysis of soils and sediments to identify any contamination hotspots (e.g., hydrocarbons, heavy metals, or chemical residues) and establish baseline and closure conditions.<br>• Implement robust erosion and sediment control measures. Install silt fences, sediment traps, earth bunds, diversion channels, and check dams around demolition and excavation areas to prevent soil loss and sediment-laden runoff from entering Lake Victoria or nearby water bodies.<br>• Stabilize exposed surfaces promptly. Apply compaction, mulching, geotextiles, or temporary grassing on all cleared, graded, or excavated areas immediately after works to minimize wind and water erosion during the decommissioning phase. | Soil test results (contaminants below limits)<br><br>Erosion features observed (target: none)<br><br>Topsoil replacement success rate | Environmental Officer / Contractor | Pre-, during & post-soil sampling; after rainfall inspections |
| *7.5.5 Water Quality & Aquatic Ecosystem Impacts* | • Treat all effluent and runoff before discharge. Collect and direct pond drainage, demolition runoff, and any process water through temporary settling ponds, sediment traps, or other appropriate treatment systems to allow suspended solids to settle and reduce nutrient loads prior to release into the environment.<br>• Use sediment barriers and containment measures. Deploy silt curtains, floating booms, or sediment barriers around active in-lake decommissioning areas and discharge points to contain suspended sediments and prevent their spread into Lake Victoria.<br>• Implement a comprehensive water quality monitoring program. Conduct regular monitoring of key parameters | Turbidity, TSS, DO, nutrients (TN, TP) levels<br><br>Visible pollution plumes (target: none)<br><br>Upstream vs downstream comparison | Environmental Officer / KeFS | Daily during active works; weekly water sampling; monthly reports |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | (turbidity, Total Suspended Solids (TSS), Dissolved Oxygen (DO), pH, nutrients (nitrogen and phosphorus), and temperature) at upstream, project area, and downstream locations during and after decommissioning activities | | | |
| *7.5.6 Habitat Restoration & Biodiversity* | • Develop and implement a detailed Site Restoration and Habitat Rehabilitation Plan. This plan shall form part of the overall Decommissioning Plan, outline specific restoration targets, methods, timelines, and success criteria, and be approved by NEMA, KeFS, and relevant ecological authorities prior to implementation.<br>• Revegetate disturbed areas with indigenous species. Use locally sourced, native plant species appropriate to the Lake Victoria shoreline ecosystem for all re-vegetation activities to restore natural vegetation cover, enhance biodiversity, and stabilize soils.<br>• Restore shoreline and buffer zones. Re-establish vegetative buffer strips along the lake shoreline and around the former project footprint to protect against erosion, filter runoff, and provide habitat connectivity for terrestrial and semi-aquatic species.<br>• Enhance benthic habitats where feasible. After removal of cages and associated infrastructure, implement targeted measures such as placement of clean, natural substrate or removal of excess organic sediment to promote recovery of benthic communities and improve habitat quality on the lakebed.<br>• Prioritize progressive rehabilitation. Conduct habitat restoration works progressively as sections of the site are cleared and stabilized, rather than waiting until all decommissioning activities are completed.<br>• Engage local communities and specialists. Involve local residents, Beach Management Units (BMUs), and qualified ecologists or botanists in the planning and implementation of restoration activities to incorporate indigenous knowledge and improve long-term success | % vegetation cover achieved<br><br>Biodiversity & benthic surveys (pre vs post)<br><br>Habitat rehabilitation success | Environmental Officer / Ecologist / NEMA | Quarterly for first year; annual for 2–3 years post-closure |
| *7.5.7 Air Quality, Dust, Noise & Vibration* | • Implement water sprinkling for dust suppression. Regularly spray water on exposed surfaces, demolition areas, access roads, and stockpiles during dry and windy conditions to minimize fugitive dust generation and prevent airborne particulate matter from affecting workers and nearby communities. | Dust (PM10) & noise levels (dB)<br><br>Community complaints received | Contractor / Environmental Officer | Daily during high-risk activities; weekly monitoring |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | • Maintain all equipment and machinery in good working condition. Conduct routine servicing and maintenance of demolition equipment, vehicles, generators, and other machinery to reduce exhaust emissions and excessive noise levels.<br>• Limit noisy works to daytime hours. Schedule high-noise activities such as concrete breaking, demolition, and heavy equipment operation strictly within normal daytime working hours (e.g., 08:00 to 18:00) to minimize disturbance to nearby residents, wildlife, and sensitive receptors.<br>• Use low-emission machinery and equipment. Prioritize modern, fuel-efficient, and low-emission equipment wherever feasible, and ensure all vehicles and machines comply with applicable emission standards. | | | |
| *7.5.8 Occupational Health & Safety Risks* | • Develop and implement a comprehensive Decommissioning-specific Occupational Health and Safety (OHS) Management Plan. This plan shall comply with the Occupational Safety and Health Act (OSHA), 2007, and other relevant regulations, and shall be approved prior to the start of decommissioning activities.<br>• Provide comprehensive safety induction and task-specific training. All workers and contractors shall receive thorough induction training on decommissioning hazards, safe work procedures, and emergency protocols before commencing work, with regular refresher sessions conducted throughout the decommissioning period.<br>• Supply and enforce the use of appropriate PPE. Provide and ensure consistent use of safety helmets, steel-toed boots, gloves, high-visibility vests, harnesses, respiratory protection, hearing protection, and life jackets for all personnel working on or near water.<br>• Conduct regular risk assessments and job hazard analyses. Identify potential hazards associated with demolition, diving operations, heavy lifting, working at heights, and hazardous materials handling, and implement appropriate control measures before starting each activity. | Training & toolbox talk records<br><br>Incident/near-miss reports (target: minimal)<br><br>PPE compliance rate | OHS Officer / Contractor | Daily toolbox talks; weekly OHS reports |
| *7.5.9 Socio-Economic Impacts & Livelihood Restoration* | • Develop and implement a comprehensive Livelihood Restoration Plan (LRP). This plan shall be prepared as part of the overall Decommissioning Plan and shall detail measures to support affected workers and local communities during and after project closure. | Number of workers supported (severance, training) | Community Liaison Officer / Project Manager | Monthly during decommissioning; post-closure evaluation |

| Impact | Mitigation Measures (Summarized) | Monitoring Indicators | Responsibility | Frequency / Reporting |
|---|---|---|---|---|
| | • Provide severance packages and financial support. Offer fair and transparent severance payments, terminal benefits, and any other entitled compensation to all employees in accordance with Kenyan labour laws and international good practice.<br>• Implement retraining and skills development programmes. Offer vocational training, entrepreneurship skills development, and alternative livelihood support to affected workers to facilitate smooth transition to new employment opportunities.<br>• Conduct extensive stakeholder consultations. Engage local communities, Beach Management Units (BMUs), workers, and other affected parties well in advance regarding the decommissioning schedule, potential impacts, and support measures through public meetings and targeted consultations.<br>• Maintain the Grievance Redress Mechanism (GRM). Keep the project GRM fully operational throughout the decommissioning and post-closure period to receive, investigate, and resolve any community or worker complaints in a timely and transparent manner.. | Grievances received & resolved<br><br>Community feedback surveys | | |
| *7.5.10 Residual Impacts & Post-Closure Monitoring* | • Conduct a comprehensive final environmental and social audit. Engage an independent and NEMA-approved auditor to undertake a detailed final audit before site handover to verify that all decommissioning activities have been completed, all mitigation measures implemented, and the site meets agreed closure standards.<br>• Implement a 1–3 year post-closure monitoring programme. Establish and execute a structured post-closure monitoring plan covering key parameters such as water quality, sediment quality, habitat recovery, vegetation establishment, erosion control, and socio-economic indicators for a minimum period of one to three years after site closure.<br>• Ensure clear liability transfer and site handover. Formalize the transfer of any residual liabilities through legal agreements with relevant authorities (NEMA, KeFS, County Government) and clearly document the condition of the site at the time of handover. | Audit findings closed out<br><br>Long-term water quality & habitat trends<br><br>Compliance with closure certificate | Project Proponent / Independent Auditor / KeFS / NEMA | Final audit at closure; monitoring reports quarterly (Year 1), then annually |

## 9. CLIMATE RISK VULNERABILITY AND ADAPTATIONS

Climate change is one of the greatest threats facing the world in the 21st century. If not addressed, it will have significant and long-lasting impacts on the lives of people around the globe. Taking action to mitigate and adapt to climate change is therefore not optional, but an urgent necessity. While the effects of climate change are already being observed, it is generally accepted that if the global temperature rise reaches 1.5°C above pre-industrial levels, the impacts on natural and human systems will be severe and potentially irreversible. These impacts include: -

- Loss of ecosystems, sea-level rise, and more frequent,
- Severe weather events, such as droughts, and
- Heatwaves, and storms,

The adoption of the Paris Agreement on Climate Change, followed by its signing by nearly 200 countries, marked a historic turning point in global climate action. Under the Paris Agreement, signatory nations committed to limiting the average global temperature increase to well below 2°C, aiming for 1.5°C. In line with this global goal, Kenya has committed to developing and implementing an ambitious Climate Action Plan (CAP) under C40's Deadline 2020 programme. This plan will align with international climate targets and contribute to mitigating climate change impacts at both the national and global levels.

### 9.1. Kenya Climate

Kenya's climate is highly diverse, with variations primarily influenced by altitude. The highlands experience a moderate mean annual temperature of around 15°C, while the lowland areas in northern and eastern Kenya can reach temperatures as high as 29°C. In contrast, the coastal region and the shores of Lake Victoria in the far west enjoy a tropical climate, with temperatures typically ranging between 23°C and 27°C. Annual precipitation in Kenya varies significantly across the country, with amounts ranging from as low as 200mm in the arid northern and eastern regions, characterized by steppe landscapes, to more than 1,600 mm in the western areas. The highland regions of Kenya experience a more moderate climate, with annual precipitation totals ranging between 800 mm and 1,000 mm.

Kenya has two rainy seasons (bimodal precipitation regime) – a major one from March to May and a minor one from October to December[1].

### 9.2. Projected Climate Changes

In response to rising greenhouse gas (GHG) concentrations, air temperatures over Kenya are projected to increase by 1.2 to 3.2°C (very likely range) by 2080, relative to the baseline year of 1876. The extent of this temperature rise will depend on the future GHG emissions scenario (Figure below). Compared to pre-industrial levels, median climate model projections indicate a temperature increase of approximately 1.4°C by 2030, and 1.7°C by both 2050 and 2080, under the low emissions scenario (RCP2.6). Under the medium to high emissions scenario (RCP6.0), median temperature increases are projected to reach 1.3°C by 2030, 1.6°C by 2050, and 2.2°C by 2080.

[1] Climate Risk Profile: Kenya

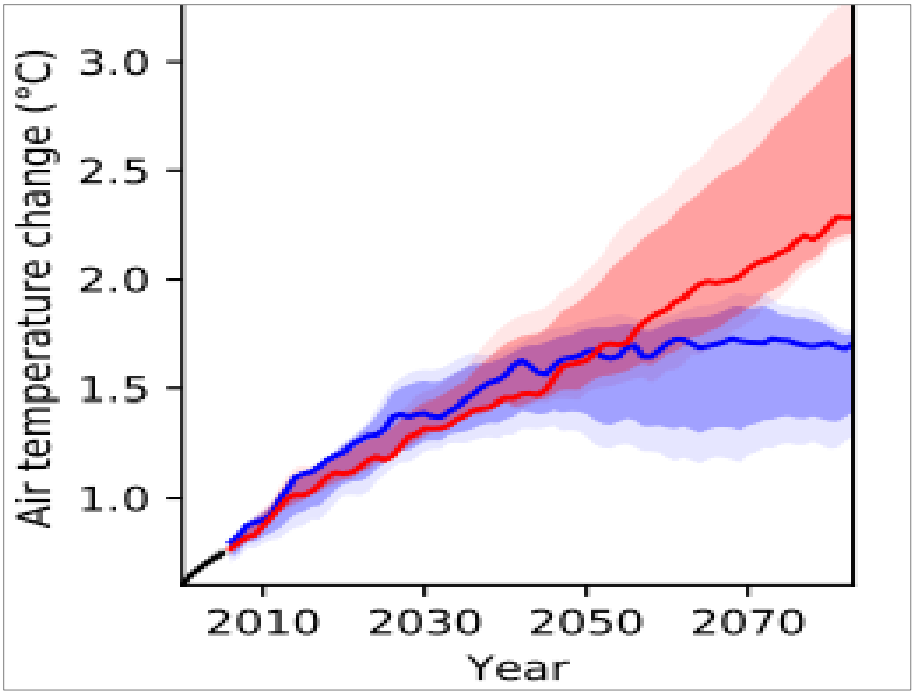


*Figure 5: Air temperature projections for Kenya for different GHG emissions scenarios.*

### 9.2.1. Very Hot Days

In line with rising mean annual temperatures, the annual number of very hot days (days with daily maximum temperature above 35°C) is projected to rise substantially and with high certainty, in particular over central and eastern Kenya. Under the medium/high emissions scenario RCP6.0, the multi-model median, averaged over the whole country, projects 25 more very hot days per year in 2030 than in 2000, 36 more in 2050 and 59 more in 2080. In some parts, especially in northern and eastern Kenya, this amounts to about 300 days per year by 2080.

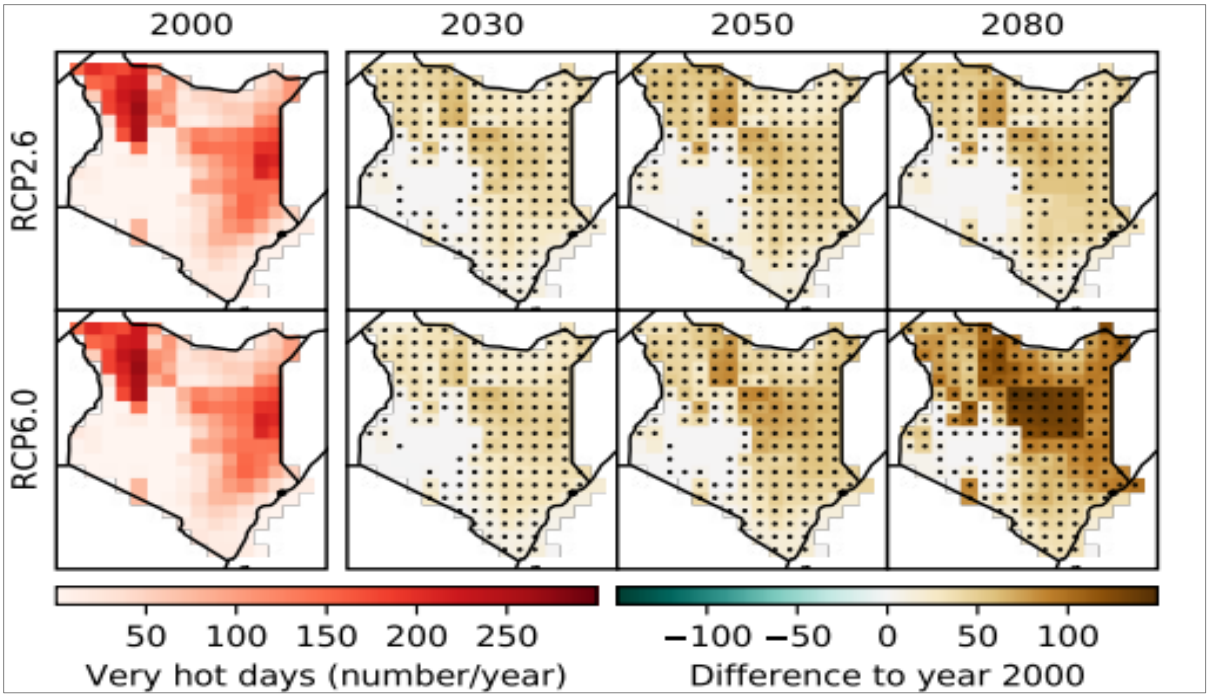


*Figure 6: Projections of the annual number of very hot days (daily maximum temperature above 35 °C) for Kenya for different GHG emissions scenarios.*

### 9.2.2. Sea Level Rise

In response to globally increasing temperatures, the sea level off the coast of Kenya is projected to rise (Figure 4). Until 2050, very similar sea levels are projected under both emissions scenarios. Under RCP6.0 and compared to year 2000 levels, the median climate model projects a sea level rise by 10 cm in 2030, 21 cm in 2050, and 40 cm in 2080. This threatens Kenya's coastal communities and may cause saline intrusion in coastal waterways and groundwater reservoirs.

### 9.2.3. Precipitation

Future projections of precipitation in Kenya are less certain than those for temperature change, primarily due to the high natural year-to-year variability in rainfall patterns. Among the three climate models used for this analysis, one model predicts either no change or a slight decrease in mean annual precipitation under the RCP6.0 scenario, while the other two models project an increase under the same emissions scenario. For the RCP2.6 scenario, median model projections suggest a slight increase in precipitation towards 2030, followed by an overall decrease towards the end of the century. Under RCP6.0, however, the projected increase in precipitation is expected to intensify after 2050, with an estimated rise of 53 mm per year by the end of the century, compared to 2000 levels. Higher emissions pathways indicate an overall wetter future for Kenya, with increased rainfall likely in certain regions.

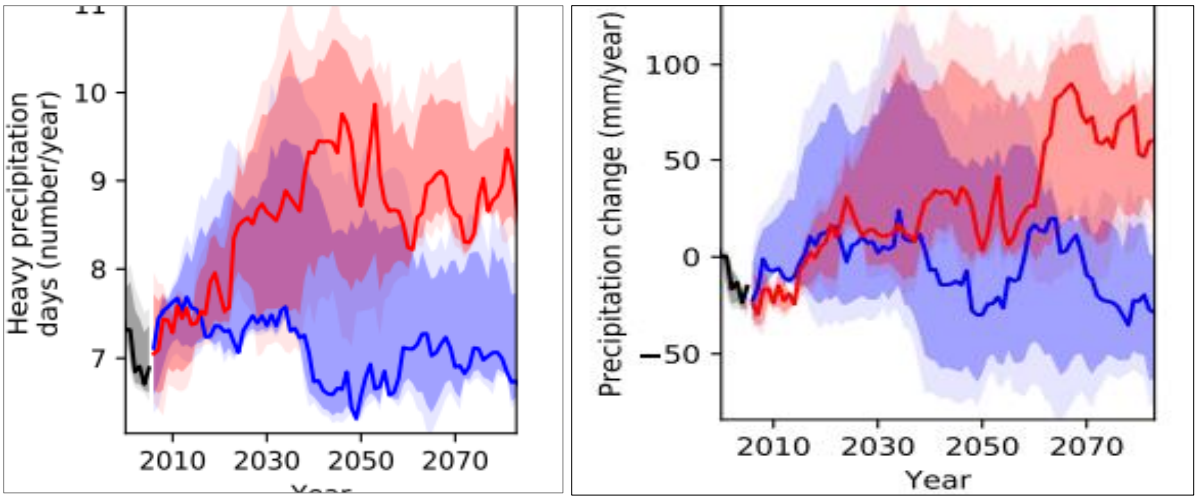


*Figure 7: Projections of the number of days with heavy precipitation over Kenya for different GHG emissions scenarios, relative to the year 2000*

In response to global warming, heavy precipitation events are expected to become more intense in many parts of the world due to the increased water vapour holding capacity of a warmer atmosphere. At the same time, the number of days with heavy precipitation events is expected to increase. This tendency is also found in climate projections for Kenya as outlined in the Figure above, with climate models projecting an increase in the number of days with heavy precipitation, from 7 days per year in 2000 to 9 days per year in 2080 under RCP6.0. Under RCP2.6, the number of days with heavy precipitation remains unchanged.

## 9.3. Climate Change Impacts to Key Sectors

### 9.3.1. Infrastructure

Climate change is projected to severely impact Kenya's transport infrastructure through extreme weather events like floods and droughts. High precipitation and temperatures will cause infrastructure damage, leading to increased maintenance costs. Since road transport is vital for agriculture, trade, and access to services, especially in rural areas, investing in climate-resilient road networks is essential. Additionally, road transport accounts for 99% of non-aviation transport GHG emissions in Kenya.

Extreme weather events will have devastating impacts on human settlements and economic sites, particularly in densely populated urban areas like Nairobi and Mombasa. Informal settlements, which often lack stable infrastructure and are built in high-risk areas such as riverbanks and coastal zones, are especially vulnerable. These areas experience severe flooding, leading to loss of housing, water contamination, and even death. Residents, who typically have low adaptive capacity due to poverty and lack of infrastructure, are particularly affected. In Nairobi's Kibera settlement, for instance, over 50% of residents reported flooding during the 2015 rainy season, resulting in deaths, disease outbreaks, and destruction of property.

### 9.3.2. Ecosystems

Climate change is expected to significantly impact tropical ecosystems, though the exact extent remains uncertain. Rising temperatures, more frequent and intense droughts, and changing conditions are putting wetlands, river systems, and forests at risk of transformation. These changes can lead to habitat loss for both plants and animals, disrupt forest succession, and increase the spread of invasive species. Additionally, factors such as low agricultural production and population growth may drive further agricultural expansion, leading to deforestation, land degradation, and forest fires, which will negatively affect biodiversity.

### 9.3.3. Agriculture

Smallholder farmers in Kenya face growing challenges due to the unpredictability of weather patterns caused by climate change. Since most crops rely on rainwater, yields are increasingly affected by erratic rainfall, while the limited use of irrigation (only 28% of the potential irrigated area in 2003) further exacerbates the situation. This is due to poor extension services, irrigation management, lack of credit, and technical equipment. The primary irrigated crops are vegetables, fruit, coffee, rice, and maize. The uncertainty in water availability projections translates into high variability in drought predictions. According to median projections, the national crop land area exposed to drought annually will only slightly increase due to global warming, though other models predict a much stronger rise. Under RCP6.0, the range of drought exposure for crop land widens from 0-0.8% in 2000 to 0-1.6% in 2080, with the very likely range increasing from 0-1.9% to 0-9.8%. Some models project a fivefold increase in drought exposure, while others show no change. Climate change will have a negative impact on yields of millet and sorghum.

### 9.3.4. Water Resources

Current projections of water availability in Kenya show high uncertainty, with median models suggesting an increase under RCP6.0 and no change under RCP2.6. However, when factoring in population growth (SSP2 projections), per capita water availability is projected to decline significantly by 73% under RCP2.6 and 63% under RCP6.0 by 2080, compared to 2000 levels. While population growth is the primary driver, these projections emphasize the need for investment in water-saving measures. Regional projections show varying trends: under RCP2.6, water availability will decrease by up to 25% in western Kenya and increase by up to 25% in southern Kenya by 2080. Under RCP6.0, the focus shifts to eastern Kenya, where water availability is expected to increase by up to 80%.

## 9.4. Homabay County Climate Risks

Climate change vulnerability is the degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with adverse impacts of climate change (IPCC, 2010). On the other hand, climate change risk in the context of climate change impacts, result from dynamic interactions between climate-related hazards with the exposure and vulnerability of the affected human or ecological system to the hazards (Reisinger et al., 2020). Thus, vulnerability to climate change increases the risk of adverse impacts because of the occurrence of climatic hazards. Time series analysis of temperature data for Homabay County show little variations between the maximum and minimum temperatures and between average monthly temperatures as shown in the Figure below.

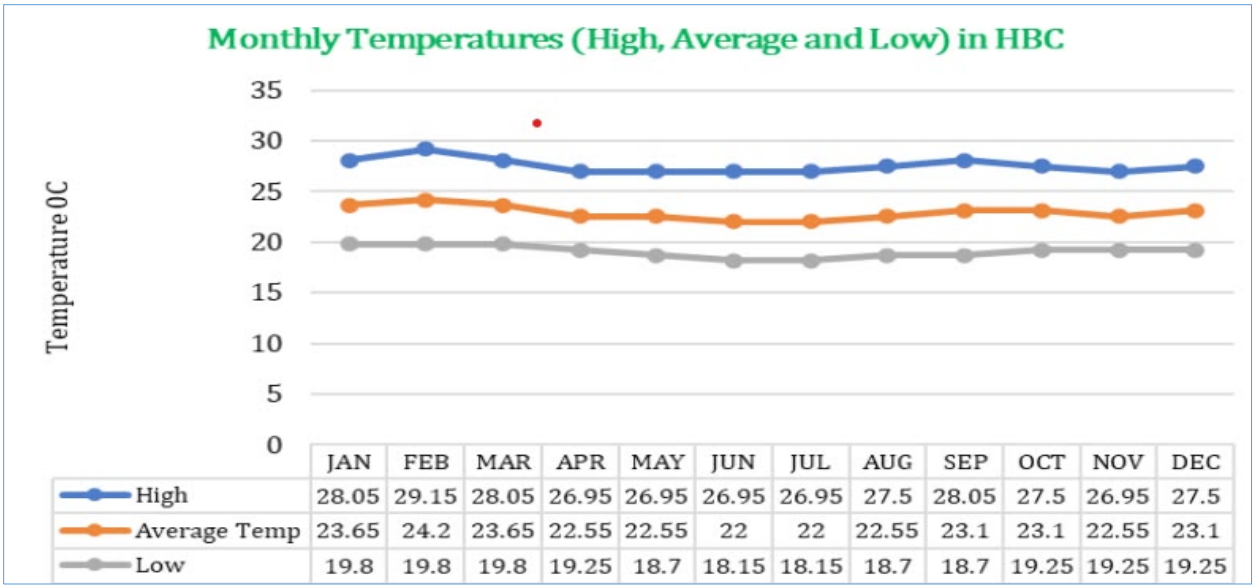


*Figure 8: Source: Metrological Department Kenya*

### 9.5. Current and Future Projections

The hottest months in Homabay County are January and March, when mean monthly temperatures average 23.65 °C, with maximum temperatures reaching approximately 28.05 °C. The coolest months are June and July, with mean monthly temperatures averaging 22.0 °C and minimum temperatures dropping to about 18.15 °C. Historical records since 1981 indicate an increase of approximately 1.0 °C in mean annual temperatures across the County. Climate projections for the period 2021–2065 suggest a further rise of about 0.4 °C. This anticipated warming is expected to exacerbate drought risk by increasing evapotranspiration rates, reducing soil moisture retention, and placing additional stress on agricultural systems, freshwater resources, and ecosystem stability[2].

#### 9.5.1. Precipitation

Homabay County lies within the equatorial climatic zone, characterized by a bimodal rainfall pattern influenced primarily by the Intertropical Convergence Zone (ITCZ) and local lake-land breeze systems from Lake Victoria. The long rainy season typically occurs from March to May, while the short rains are experienced between October and December. Average annual precipitation in the County is approximately 1,100 mm, with significant spatial and temporal variability. The highest monthly rainfall is recorded in April, averaging 198.1 mm, while the lowest occurs in July, averaging 38.1 mm. Historical data since 1981 indicate marked interannual fluctuations in rainfall patterns. Periods of reduced precipitation have been linked to recurrent drought hazards, adversely affecting agriculture, fisheries, and water availability. Conversely, years with above-average rainfall have been associated with increased flood incidences, particularly in low-lying riparian zones and areas adjacent to river floodplains.

Climate projections for the period 2021–2065 indicate an estimated 0.7 percent increase in mean annual precipitation. While this increase appears modest, its potential impacts are significant, particularly when coupled with existing drainage constraints and land-use pressures. The projected change is expected to elevate the frequency and severity of flood hazards, thereby intensifying risks to infrastructure, livelihoods, and ecosystem stability.

[2] Kenya County Climate Risk Profile Series-Homabay County Climate Risk Profile

### 9.5.2. Climate Change Risks, Hazards and Vulnerabilities in Homabay County

A hazard refers to the potential occurrence of a climate-related physical event or long-term climatic trend that may cause adverse impacts, including damage to infrastructure, loss of livelihoods, and degradation of ecosystems. In Homabay County, communities and community-based organizations as well as researchers have identified floods and droughts as the most frequent and significant climate-related hazards. As outlined in earlier sections of this report, precipitation and temperature are the key climatic variables driving the occurrence of these hazards. The interaction between these climatic variables and the County's exposed human and ecological systems results in identifiable climate change risks as outlined in the Table 8 below.

Precipitation variability can lead to either drought or flood hazards, depending on magnitude and intensity. Low precipitation is typically associated with drought conditions, which in turn increase the likelihood of water scarcity, reduced agricultural productivity, and disease outbreaks. Conversely, high or extreme precipitation events contribute to flooding, which may cause property damage, displacement of communities, and a rise in Lake Victoria's water levels. Temperature increases are primarily linked to drought hazards, as elevated temperatures intensify evapotranspiration rates and reduce soil moisture, leading to more frequent and severe drought episodes. Temperature extremes also disrupt aquatic ecosystems, including fish breeding cycle.

*Table 8: Climate Variables, Associated Hazards, and Climate Change Risks in Homabay County*

| Climatic Variable | Magnitude | Climatic Hazard | Climate Change Risks |
|---|---|---|---|
| **Precipitation** | Low | Drought | • Occurrence of droughts<br>• Disease outbreaks<br>• Irregular fish breeding patterns |
| | High | Floods | • Increased flooding incidences<br>• Rise in Lake Victoria water levels<br>• Disease outbreaks |
| **Temperature** | Elevated | Drought | • Increased drought incidence<br>• Disruption of fish breeding patterns |

### 9.5.3. Climate Change Vulnerabilities in Homabay County

Climate change vulnerabilities heighten the likelihood and severity of climate-related impacts by diminishing the adaptive capacity of human and ecological systems. In Homabay County, these vulnerabilities manifest in various forms, including decreased crop production, loss of income, emergence of new and aggressive insect species, pests and diseases, erosion of livelihoods, and loss of life. The specific vulnerabilities associated with each identified climate change risk are outlined in Table 9 below.

*Table 9: Climate Change Risks and Associated Vulnerabilities in Homabay County*

| Climatic Variable | Climate Change Risks | Associated Vulnerabilities |
|---|---|---|
| **Precipitation *(High)*** | • Flooding<br>• Rise in Lake Victoria water levels | • *Decreased crop production*<br>• *Food scarcity*<br>• *Emergence of new and aggressive insects and pests*<br>• *Loss of income*<br>• *Low milk productivity*<br>• *Livestock diseases*<br>• *Loss of livelihoods*<br>• *Inadequate water supply* |

| | | |
|---|---|---|
| | | • *Spread of infectious and contagious diseases*<br>• *Loss of life* |
| **Temperature *(Elevated)*** | • Droughts<br>• Airborne diseases | • *Decreased agricultural productivity*<br>• *Emergence of aggressive and invasive insects and pests*<br>• *Loss of productive agricultural land*<br>• *Loss of income*<br>• *Declining livestock productivity*<br>• *Loss of livelihoods*<br>• *Inadequate water for human and livestock use*<br>• *Loss of life*<br>• *Spread of infectious and contagious diseases* |

### 9.6. Climate Change Risks and Adaptation

Climate change poses additional risks to the proposed integrated aquaculture project at Tabla Beach through increased frequency and intensity of extreme weather events, rising temperatures, changing rainfall patterns, and potential shifts in Lake Victoria water levels and quality. These changes could exacerbate existing environmental and operational impacts, including fish mortality, infrastructure damage, water quality deterioration, and reduced productivity. The project will therefore integrate climate change adaptation and resilience measures throughout its lifecycle (construction, operation, and decommissioning) to ensure long-term sustainability and minimize climate-related vulnerabilities.

**Mitigation and Adaptation Measures**

- Conduct climate risk screening and vulnerability assessment. Identify site-specific climate risks (e.g., extreme storms, droughts, flooding, temperature rise) using the latest available climate projections for the Lake Victoria Basin and incorporate findings into project design and siting decisions.
- Design climate-resilient cage structures and mooring systems. Use stronger, more durable materials (e.g., high-density polyethylene (HDPE) with reinforced netting) and improved anchoring systems capable of withstanding stronger winds, higher waves, and fluctuating water levels. Consider deeper or more sheltered cage placement where feasible.
- Elevate and reinforce land-based infrastructure. Construct pond embankments, hatchery buildings, feed storage, and the ice processing plant with adequate freeboard and flood-resistant designs to withstand increased rainfall intensity and potential lake level rise.
- Implement water conservation and storage measures. Harvest and store rainwater in reservoirs or tanks for use during drought periods. Install efficient water recirculation systems in ponds and hatcheries to reduce dependency on lake water abstraction.
- Enhance water quality and temperature management. Install aeration systems and shading structures (where appropriate) to maintain adequate dissolved oxygen levels and mitigate the effects of higher water temperatures. Monitor water temperature regularly and develop contingency plans for heat stress events.
- Strengthen early warning and emergency response systems. Establish a functional early warning mechanism for extreme weather events (storms, heavy rainfall, droughts) in collaboration with meteorological authorities and local communities. Update the project Emergency Response Plan to include climate-related scenarios such as cage damage, flooding, and mass fish mortality.

## 10. LIMNOLOGY, LAKE SEDIMENT ANALYSIS AND BIOSAFETY PLAN

This chapter details the limnology of the Project area, analysis of the laboratory analysis of the sampled lake sediment and biosafety/biosecurity plan of the proponent. The term Limnology is derived from Greek word; Limne means lake and logos means knowledge. Limnology is often regarded as a division of ecology or environmental science. It is however, defined as "the study of inland waters" (running and standing waters fresh and sometimes saline; natural or man-made). This includes the study of lakes, ponds, rivers, reservoirs, swamps, streams, wet lands, bogs, marshes etc. Hence, it is commonly defined as that branch of science which deals with biological productivity of inland waters and with all the causal influences which determine it (Welch, 1963). Biological productivity, as used in this definition, includes its qualitative and quantitative features and its actual and potential aspects.

### 10.1. Baseline Parameters of the project area

The proponent's sustainable and socially responsible expansion project is to be located in the waters of Lake Victoria in off shore concessions in Nyamanga Sub-Location, Gembe West Location, Suba North Sub County, Homabay County. Lake Victoria is the largest lake in Africa (68,000 KM2) with an average depth of 40M (130 Ft). The lake's shoreline is long (about 3,500 km) and convoluted, enclosing innumerable small, shallow bays and inlets, many of which include swamps and wetlands, which differ a great deal from each other and from the lake itself. The lake has a wide land catchment area, which is almost three times the size of the lake, and extends over the three East African countries together with Rwanda and Burundi. This is the area from which rivers carry water, nutrients, sediments and pollutants into the lake and is about 193,000 km2; of which the catchment area in Kenya covers 42,460 km2.

Lake Victoria has numerous wetlands on the edges of its shore as well as open beaches and islands. The coastline ranges from papyrus swamps to rocky and sandy beaches. The wetlands are important for fish breeding and growth; for filtering river waters; the wetlands plants are harvested for building materials by the riparian communities and are food for wildlife. The lake serves as an important reservoir for the region and for the larger Nile Basin. Because the lake is shallow (Fig. 2), its volume is substantially less than that of other African Great Lakes, which have much smaller surface areas. Its total volume is about 2,760 km3, only 15% of the volume of Lake Tanganyika, even though the latter has less than half its surface area. In the Winam Gulf of Lake Victoria, 8.1 billion m3 of water comes from rainfall over its surface and in-flowing rivers contribute 9.2 billion m3. The rivers, which originate from and enter the Lake in the Kenyan catchment contribute 38% of the total river discharge entering Lake Victoria from land catchment, however River Mara, which enters the lake in Tanzania and contributes about 5% is mainly from the Kenyan catchment, therefore total contribution of Kenyan catchment is estimated at about 42% of land catchment input. Consequently, activities in Kenya catchments potentially affect a substantial portion of the river discharge to the lake and especially in Winam Gulf. The table 10 below indicates the discharges of several rivers that feed into Lake Victoria.

*Table 10: River discharges and their % contribution to Lake Victoria land catchment input.*

| River | Discharge, $m^3s^{-1}$ | % Kenya basin | % Whole basin |
|---|---|---|---|
| Sio | 11.4 | 3.5 | 1.5 |
| Nzoia | 115.3 | 35.0 | 14.8 |
| Yala | 37.6 | 11.4 | 4.8 |
| Nyando | 18.0 | 5.5 | 2.3 |
| North Awach | 3.7 | 1.1 | 0.5 |
| Sondu-Miriu | 5.9 | 1.8 | 0.8 |
| South Awach | 42.2 | 12.8 | 5.4 |
| Kuja-Migori | 58.0 | 17.6 | 7.5 |
| Mara | 37.5 | 11.4 | 4.8 |
| Total, whole basin | 778.3 | 100 | 42.4 |

***Source: J .O. Okungu, et al***

Studies on the water exchange between the Winam Gulf and the open lake have been undertaken under the water quality component. Measurements and modelling of the hydraulic conditions at the Rusinga channel has been a major objective to understand water fluxes and movements of water borne materials between the littoral and pelagic areas of the lake. The largest loss of Lake Victoria water (76%) is through evaporation from the lake surface the rest leaves the lake through the outflow into Victoria Nile at Jinja. The greatest input of water into the lake is from direct rainfall onto the lake surface (82%). Therefore, only about 18% of combined rainfall and river inflow water exits the lake at the Nile. The Nile provides critical water supplies for nations beyond the basin and so there is continuous interest internationally, as well as in the basin, in the quantity and quality of water leaving Lake Victoria (Khisa, et al.,)

The literature on limnology of the Kenyan waters of Lake Victoria is rather scanty. However, extensive measurements of water currents, temperature dissolved oxygen and winds on the Kenyan waters of the lake were done by Ochumba (1996). Hypolimnion temperatures as low as 23.5°C observed in 1928 by Worthington (1930) in the 1950s (Fish 1957) and in 1960-61 (Talling, 1966) were not seen, suggesting a response of Lake Victoria to a possible warning trend in the climate of East Africa. Ochumba (1996) also reported that oxygen conditions have deteriorated since 1950. Hecky et al. (1994) concluded that low oxygen conditions are now more extensive and persistent than previous investigators had found. Aware of these immense benefits of Lake Victoria, the proponent has taken every measure to conduct baseline studies to determine physio-chemical conditions of the project site before implementing the project. Regular water quality assessment has been carried out. Zooplankton dynamics in Lake Victoria was outline by Bransrator et al (1996), who suggested that the composition of cladocerans, calanoid copepods and cyclopoid capepods in the modern community were largely unchanged from historical conditions although the proportions may have changed

The project site is located in the off shore areas of Tabla Beach in Suba North Sub County, Homabay County. The shoreline is hilly, with rocky bays and well curved coast line. The water depth at the project site is approximately 28m.

### 10.2. Fisheries Resources in the project area

Since the 1970s total fish catches have increased by between four and five times after the introduction of exotic species such as the Nile Perch (Mbuta). However, catch per fishing effort has been dropping while effort has continued increasing, indicating that the maximum sustainable yield is below the present level of exploitation. Furthermore, introduction of exotic species of fish has altered the food web structure of Lake Victoria, which has led to a dramatic decline in diversity of indigenous fish species. A number of original 300 species of fish are now extinct or facing depletion. Other factors which have affected the status of lake and

riverine fisheries in the project area are: overfishing by use of small mesh nets and harvesting of brood stocks; destruction of fish habitats through river engineering; siltation due to deforestation, algal blooms due to nutrient enrichment, pollution, wetland conversion and development, fish pathogens and water hyacinth infestation. It is important to note that the project area is over 30 meters deep, thus the main fish species that can be found in the area is Nile perch. However, the proponent will culture Tilapia species within the HDPE cages while taking deliberate actions to avoid any escape of fingerlings to the lake.

### 10.3. Project Site Sediment Analysis

As mentioned previously, Lake Victoria receives waters of varying quality from several rivers, precipitation, recharge from groundwater; industrial and domestic waste treatment and disposal systems, urban and agricultural run-offs. These waters, rich in nutrients encourage biological activities within the lake that are a source of biogenic sediments. To a small extent, shoreline erosion is also responsible for the sediments found in the lake. The need to carry out sedimentation and sediment characteristics at the project site was to generate baseline information on bio-physical parameters of the project area sediments. This was important because of future monitoring of project/s impact on the lake sediment. The table below shows the results analysis of the sampled sediment in the project area:

**Sediment Analysis Results**

| | | | |
|---|---|---|---|
| **Date Received:** | 6/10/2025 | **Date Analysis Started:** | 6/11/2025 |
| **Date Analysis Completed:** | 6/13/2025 | **Date Released** | 6/24/2025 |

| [2] PARAMETER | METHOD | RESULTS | [1] STANDARD (Max Limits) |
|---|---|---|---|
| Chemical | | | |
| **Total Petroleum Hydrocarbons (TPH)** | | | **np** |
| C5 - C12, mg/L | CSITP 033 | 0.0005 | **np** |
| C12 - C28, mg/L | CSITP 033 | 0.0011 | **np** |
| C28 - C44, mg/L | CSITP 033 | 0.0019 | **np** |

**np - No standard reference for the parameter**
**BDL- Below Detection Level**
**To maintain the correct history ensure that the next sample sent from this Water Source is labelled: Lake Water**
**These results relate to the items sampled.**
**Sampling Method: CSL/QMS/STIRH/SP 20 - Test Item Receipt, Sampling, and Handling Procedure**
**History is 30 days**

### 10.4. Biosafety/Biosecurity Plan

The proponent's biosecurity plan aims to prevent disease, improve fish welfare, and increase productivity and profitability. The biosecurity measures are designed to improving fish welfare and productivity to increase the efficiency of inputs and the sustainability of the system.

The objectives of the plan are to:

- better fish health and improved performance;
- mitigate the transmission and amplification of diseases between cages and concessions;
- allow for early disease detection so that impacts can be reduced;
- support claims of freedom from diseases that impact marketability and market access;
- facilitate translocation within and between production sites;

- reduce the risk of diseases from being introduced to the farm, spreading within the farm, or escaping from the farm;
- have emergency response protocols in place for serious disease outbreaks.

The biosecurity plan fulfills the legal requirement mandated by the Kenya Fisheries Service (KFS) and ensures that during project implementation, off-shore concessions are chosen and designed in line with the surrounding topography, assuring optimum water quality conditions for animal welfare. Cages are spaced in order to assure water quality within each cage, reduce the risk of disease transmission, and minimize environmental impacts. Biosecurity and Biosafety plan covers both lake-based and land-based aquaculture of the proponent. All broodstock shall be produced on the farm and maintained off-shore in cages. Upon maturation, broodstock will be moved to breeding ponds, allowing the tilapia to practice their natural breeding behaviours, including burrowing and mouth-breeding. Eggs shall be collected from the females' mouths and incubated in a hatchery building, where optimum water quality shall be assured through a recirculating aquaculture system (RAS).

#### 10.4.1. Traceability

The proponent shall record for traceability at the cage level, such that each cage can be traced back to the broodstock group that produced those eggs. Groups of broodstock shall be kept separately in ponds, and eggs from that pond will be labelled and identified by the pond of origin and date of collection. This identifying information shall be retained with the fry and fingerlings upon transfer to the pond nursery, the cage nursery, and eventually the grow-out cage. Fish shall be delivered to each retail outlet and should be traced back to the cage using the harvest date and the cage number recorded in during processing. These records shall be retained for at least 10 years.

#### 10.4.2. Disease checkpoints

Staff shall record observations for indications of disease at all lifecycle stages. Broodstock and fish at nursery and grow-out stages shall be observed for lesions, physical abnormalities, and irregular swimming and eating behaviours. Eggs and fry shall be observed for physical or other developmental abnormalities. Observations shall be reported to management and recorded. At all stages, mortalities shall be promptly removed from the environment and disposed of using biosecure disposal protocols. The daily number of mortalities shall be recorded for each cage and pond.

#### 10.4.3. Annual Biosecurity Risk Assessment

The proponent shall conduct an annual biosecurity risk assessment. The resulting report shall be stored in the main office and is used to inform annual revisions to the biosecurity plan. Audit reports shall also be stored in the main office.

#### 10.4.4. Location of Cage Farms

This cage farm proposes to exceed Kenya Fisheries Guidelines of 500 meters between cage farms to 5 Kilometers between cage farms to enhance biosecurity of its operation.

# 11. CONCLUSION AND RECOMMENDATIONS

## 11.1. Conclusion

The proposed integrated aquaculture project at Tabla Beach, Suba North Sub-County, Homabay County, involving both lake-based cage culture and land-based ponds, hatchery, and supporting facilities (including an ice processing plant), is expected to deliver significant socio-economic benefits to the local community and contribute to Kenya's national goals of food security, employment creation, and blue economy development.

Key positive impacts of the proposed project shall include but not limited to:

f) Creation of direct and indirect employment opportunities during construction and operation phases;
g) Increased fish production to meet local and regional demand for high-quality protein;
h) Stimulation of local economic activities through supply chains, services, and market linkages;
i) Transfer of aquaculture skills and technology to local communities; and
j) Potential for improved livelihoods and reduced pressure on wild fish stocks in Lake Victoria.

The ESIA has identified several potential negative impacts, particularly related to water quality, lakebed disturbance, waste management, habitat alteration, fish disease risks, user conflicts, and climate change vulnerabilities. However, with the implementation of the comprehensive mitigation measures outlined in this ESMP (*Sections 7.1 to 7.6*), these impacts can be effectively avoided, minimized, or adequately compensated.

The project is therefore considered environmentally and socially acceptable provided that all recommended mitigation measures, monitoring programs, and management plans are fully implemented. The risks associated with construction, operation, and eventual decommissioning are manageable through good industry practices, strict regulatory compliance, and adaptive management. Climate change risks, while significant in the Lake Victoria Basin, can be addressed through proactive adaptation measures integrated into project design and operations. Overall, the project aligns with national policies including the Kenya Vision 2030, the Blue Economy Strategy, Sustainable Development Goals (SDGs 2, 8, 13, and 14), and relevant fisheries and environmental legislation as well as Homabay Aquaculture and Blue Economy Policy.

## 11.2. Recommendation

The following recommendations are made to ensure sustainable development and operation of the proposed aquaculture project:

vi. The Project Proponent should integrate the entire ESMP (including Construction, Operational, Decommissioning, and Climate Change Adaptation sections) into all project contracts and operational procedures.
vii. Allocate adequate financial resources for the implementation, monitoring, and auditing of the ESMP throughout the project lifecycle.
viii. The proponent should obtain all necessary licenses, permits, and approvals from NEMA, Kenya Fisheries Service (KeFS), County Government of Homabay, and other relevant authorities before commencing any works.
ix. Maintain continuous, transparent, and inclusive engagement with local communities, Beach Management Units (BMUs), fishers, and other resource users.
x. Implement a robust monitoring program with clearly defined indicators, frequencies, and responsibilities as detailed in the ESMP tables.

It is highly recommended that the proposed aquaculture project at Tabla Beach be approved subject to strict adherence to the mitigation measures, monitoring requirements, and management plans presented in this ESIA/ESMP report. With effective implementation, the project will provide substantial socio-economic benefits while maintaining the ecological integrity of Lake Victoria and the well-being of local communities.

The successful delivery of this project will serve as a model for sustainable commercial aquaculture development in the Lake Victoria Basin, contributing to Kenya's blue economy agenda and long-term food security.

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THE REPUBLIC OF KENYA

BUSINESS REGISTRATION SERVICE
P. O. BOX 30031
NAIROBI
SAT, 07 JUNE, 2025

**To**
The Director(s)
HOPE AGRITECH LIMITED
P.O. Box 21826
00505 - 4378

## THE COMPANIES ACT, 2015

[ SECTION 249 OF THE COMPANIES ACT, 2015 ]

Records relating to the below company held by the Companies Registry as at **Sat, 07 June, 2025**

| | |
|---|---|
| COMPANY | HOPE AGRITECH LIMITED |
| TYPE OF COMPANY | PRIVATE LIMITED COMPANY |
| COMPANY NUMBER | PVT-YQ19W6VJ |
| NOMINAL SHARE CAPITAL | 100000 |
| NUMBER AND TYPE OF SHARES (VALUE PER SHARE) | 5000 ORDINARY SHARES OF KES. 20 |
| DATE OF REGISTRATION | SAT, 07 JUNE, 2025 |
| REGISTERED OFFICE | TELEPHONE: +254711358864, EMAIL: HORIZONEQUATOR8@GMAIL.COM<br>COUNTY: NAIROBI, DISTRICT:DAGORETI DISTRICT, LOCALITY: KILELESHWA<br>STREET: KASUKU ROAD, BUILDING: ALBA GARDENS |
| POSTAL ADDRESS | P.O BOX 21826, 00505 - NGONG ROAD |
| ENCUMBRANCES | |

Name of Directors and Shareholders of the above company with their particular are as follows

| NAME | DESCRIPTION | ADDRESS | NATIONALITY | SHARES |
|---|---|---|---|---|
| DING JIANGHUA | DIRECTOR_SHAREHOLDER | **P.O. BOX** 21826 00505 - NGONG ROAD | CHINA | 2500-ORDINARY |
| HU YUNWEN | DIRECTOR_SHAREHOLDER | **P.O. BOX** 2471 00200 - CITY SQUARE | CHINA | 2500-ORDINARY |

Yours Faithfully,
REGISTRAR OF COMPANIES

**REF NO: PVT-YQ19W6VJ**

**DISCLAIMER**: THIS IS A SYSTEM GENERATED CERTIFICATE AND DOES NOT REQUIRE A SIGNATURE

KENYA REVENUE AUTHORITY

# PIN Certificate

For General Tax Questions
Contact KRA Call Centre
Tel: +254 (020) 4999 999
Cell: +254(0711)099 999
Email: callcentre@kra.go.ke

www.kra.go.ke

**Certificate Date :** 10/06/2025

**Personal Identification Number**
P052438793Y

This is to certify that taxpayer shown herein has been registered with Kenya Revenue Authority

## Taxpayer Information

| | |
|---|---|
| **Taxpayer Name** | HOPE AGRITECH LIMITED |
| **Email Address** | PHYLLTRAPEE7@GMAIL.COM |

## Registered Address

| | |
|---|---|
| **L.R. Number :** | **Building :** ALBA GARDENS |
| **Street/Road :** KASUKU ROAD | **City/Town :** NAIROBI |
| **County :** Nairobi | **District :** Westlands District |
| **Tax Area :** Westlands | **Station :** West of Nairobi |
| **P. O. Box :** 21826 | **Postal Code :** 00505 |

## Tax Obligation(s) Registration Details

| Sr. No. | Tax Obligation(s) | Effective From Date | Effective Till Date | Status |
|---|---|---|---|---|
| 1 | Income Tax - Company | 09/06/2025 | N.A. | Active |

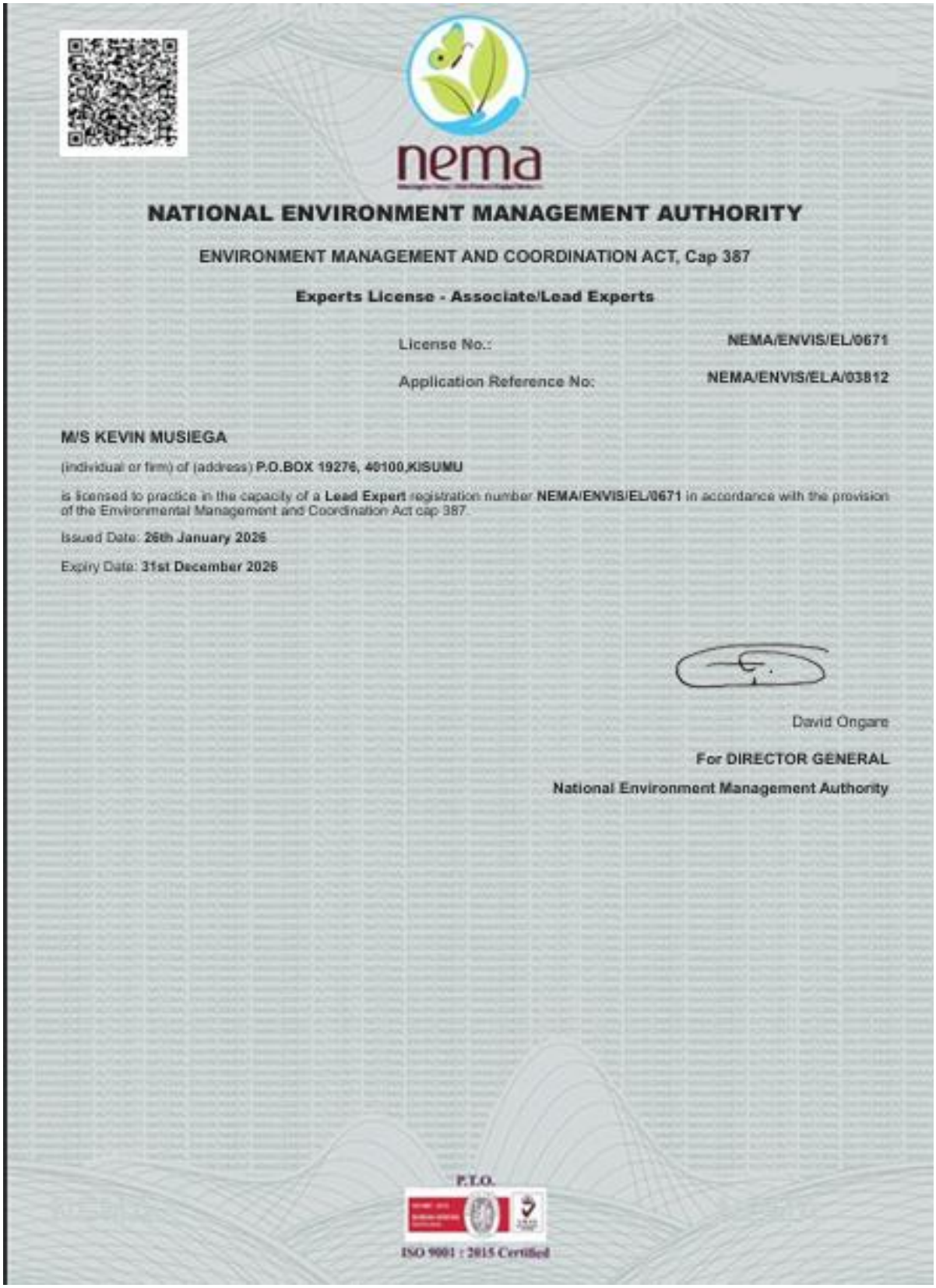
## Electronic Tax Invoicing Status

| | |
|---|---|
| **eTims Registration:** Inactive | **Tims Registration:** Inactive |

The above PIN must appear on all your tax invoices and correspondences with Kenya Revenue Authority. Your accounting end month is December unless a change has been approved by the Commissioner-Domestic Taxes Department. The status of Tax Obligation(s) with 'Dormant' status will automatically change to 'Active' on date mentioned in "Effective Till Date" or any transaction done during the period. This certificate shall remain in force till further updated.

**Disclaimer :** This is a system generated certificate and does not require signature.

**Expert License**



NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

ENVIRONMENT MANAGEMENT AND COORDINATION ACT, Cap 387

**Experts License - Associate/Lead Experts**

License No.: NEMA/ENVIS/EL/0671

Application Reference No: NEMA/ENVIS/ELA/03812

**M/S KEVIN MUSIEGA**

(individual or firm) of (address) **P.O.BOX 19276, 40100,KISUMU**

is licensed to practice in the capacity of a **Lead Expert** registration number **NEMA/ENVIS/EL/0671** in accordance with the provision of the Environmental Management and Coordination Act cap 387.

Issued Date: **26th January 2026**

Expiry Date: **31st December 2026**

David Ongare

**For DIRECTOR GENERAL**

**National Environment Management Authority**

P.T.O.

ISO 9001 : 2015 Certified

# NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

## ENVIRONMENTAL MANAGEMENT AND COORDINATION ACT, Cap 387

**Experts License - Firm of Experts**

License No.: **NEMA/ENVIS/ELI/F0046**

Application Reference No: **NEMA/ENVIS/EL/00257**

**M/S Lakers Consultancy Limited**

(individual or firm) of (address): **P.O.BOX 19276, 40100,KISUMU**

is licensed to practice in the capacity of a registration number **NEMA/ENVIS/ELI/F0046** in accordance with the provision of the Environmental Management and Coordination Act cap 387.

Issued Date: **15th January 2026**

Expiry Date: **31st December 2026**

David Ongare

**For DIRECTOR GENERAL**

**National Environment Management Authority**

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ISO 9001 : 2015 Certified