



THE REPUBLIC OF ZAMBIA

MINISTRY OF FISHERIES & LIVESTOCK



AFRICAN DEVELOPMENT BANK

ZAMBIA AQUACULTURE ENTERPRISE DEVELOPMENT PROJECT

KAFUE SITE



ENVIRONMENTAL PROJECT BRIEF

IN RESPECT OF THE PROPOSED CONSTRUCTION OF A FOOD SAFETY
LABORATORY, NATIONAL AQUATIC ANIMAL HEALTH
LABORATORY, AND QUARANTINE FACILITY IN KAFUE DISTRICT

December 2020

Prepared by



**Kaizen Consulting
International**

Plot 10C Middle Way,
Kabulonga
LUSAKA, ZAMBIA
E-mail: jchishiba@gmail.com

in association, with


JBN 
Solutions that last

Plot 43, Najeera Road
P. O. Box 28434,
KAMPALA, UGANDA
Tel.: +256-772-459792,
E-mail: info@jbn.co.ug

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The persons whose signatures are appended herein, certify that this procedure has been reviewed and accepted, and demonstrates that the signatories are aware of all the requirements contained herein and are committed to ensuring their provision.

Approvals	Name	Position	Signature	Date
<i>Compiled by</i>	<i>Orleans Mwenya</i>	<i>Project Engineer</i>		<i>5th December, 2020</i>
	<i>Chisha Chanda</i>	<i>Water Quality Specialist</i>		<i>5th December, 2020</i>
	<i>Godfrey Chileshe</i>	<i>Socio -Economist</i>		<i>5th December, 2020</i>
	<i>Kalonga Mainza</i>	<i>Fisheries Expert</i>		<i>5th December, 2020</i>
<i>Approved for issue by</i>	<i>Nelson Omagor</i>	<i>ESIA Team Leader</i>		<i>10th December, 2020</i>

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EXECUTIVE SUMMARY

Introduction

The Government of the Republic of Zambia has received financing from the African Development Bank (AfDB) towards the implementation of The Zambia Aquaculture Enterprise Development Project (ZAEDP) under the Ministry of Fisheries and Livestock (MoFL). The project is five years running from 2017-2022. The Zambia Aquaculture Enterprise Development Project (ZAEDP) aims at stimulating a viable aquaculture subsector in Zambia in order to promote economic diversification, food security and sustainable employment generation, all of which are central priorities of the Government of Zambia. The development goal is to develop a domestic aquaculture subsector, which serves as viable and inclusive business opportunity through enhanced production and productivity to improve the livelihoods of men and women beneficiaries along the aquaculture value chain.

The project will be executed in the identified Aquaculture Parks in *Chipepo, Lake Bangweulu, Kafue, Kasempa, Rufunsa* and *Mungwi* as well as in other high aquaculture potential zones across the country. Targeted fish farmers are expected to improve their business and managerial skills and the quality of their productive systems in order to increase output, efficiently, while keeping fish prices affordable and meet growing demand from the lucrative domestic market. The project has three (3) components namely:

- a) Support to Aquaculture Entrepreneurs.
- b) Support to Growth Enabling Infrastructure; and
- c) Project Management and Institutional Capacity Building.

Per the Environmental Management Act No. 12 of 2011 in line with the Environmental Impact Assessment Regulations No. 28 of 1997 Regulation 7(2), specifically requires that, a developer prepares and submits an EIA report to ZEMA for approval before implementation for a project of this magnitude. This Project Brief has therefore been prepared to meet both ZEMA and AfDB Environmental and Social requirements in respect of the proposed Construction of a Quarantine Facility, demonstration ponds National Aquatic Animal Health Laboratory and Food Safety laboratory project to be implemented in Kafue District. The environmental and social impact assessment intended to objectively assess, evaluate and propose mitigation measures for the potential impacts that may arise because of implementing the project and to assist the Zambia Environmental Management Agency (ZEMA), to decide on the implementation of the project in Kafue District.

Project Location-Kafue District

The project site is in Kafue District and is situated at approximately 900m north east of the Nangongwe Primary School located along Kafue Road (T2). From Lusaka District, the site is accessed via Kafue Road turning left at Nangongwe Primary school (1.5km after NCCI Kafue Gospel church) and about 1km before the Zebra Crossing. The site is 2.5km away from the Central Business District (CBD). The GPS coordinates of the proposed project site is -15.786585S and 28.178545E lying at an average elevation of 1230m above mean sea level.

Project Description

ZAEDP facilities to be constructed in Kafue are as follows: (i) Fish Ponds (Breeding, research, quarantine, production) 3000sq.m (ii) 1 Standard Food Safety Laboratory measuring 600 sq. m, (iii) 1 National Aquatic Animal Health Laboratories measuring 600 sq. m (iv) 1 indoor and outdoor quarantine laboratory measuring 300sq. m.

Total Project Cost

The total project cost is **USD 1. 8 million**. The project will run for five years starting from 2017-2022.

Project Objectives

The main objective of the project is to improve access to quality food and aquatic animal health assessments and testing through construction and operationalization (equipment & personnel) of ISO compliant food safety laboratory, establishment of national aquatic animal health laboratory and establishment of a quarantine facility in Kafue District.

Project Alternatives

The following were the design alternatives evaluated and selected to ensure that the project is environmentally and socially acceptable.

Site alternative

The land comprising the project site is owned by the Department of Fisheries. The proposed project area was identified as being a suitable for the proposed development because of its size, location, and nature. As such, Kasaka Fisheries Training Institute was also considered as a project alternative site. Other distinct advantages of the site include:

- a. Its proximity to Kafue River and Kafue Road.
- b. The site has good aesthetic attributes, i.e. topography and river systems; and
- c. The site is geologically stable to accommodate the project.

Power supply alternatives

The facility will be connected to the ZESCO electricity power supply line. The project area is very close to ZESCO 33/11 KV overhead power lines. Alternative power will be a silent 42KVA genset.

Water supply alternative

Lusaka Water Supply and Sanitation Company will be the main source of water and 2 boreholes will be sunk at the facility to supplement the water needs of the project.

Waste Management alternative

Solid waste will be collected by a licensed waste collector and disposed of at a licensed landfill. Using of waste and skip bins will be used for domestic waste.

Sewerage Management alternative

The sewage will be discharged into the Lusaka Water Supply and Sanitation Company mains network. The project area is in an area serviced by the water utility company.

Technology

The ZAEDP was looking for a planning approach and design that would be founded on sound environmental principles that would optimize the land area available and consider the existing topography, hydrology and vegetation. The technology to be used in project implementation will make use of human and machine labour. No other technology alternatives were considered.

Material Alternatives

The following material alternatives were considered: Glass curtain windows, re-used wood and sandstone tile: This is the modern material that is used in building construction. This combination of materials is expensive but looks very beautiful. Earth, concrete and brick work - This material has been used in building construction. It is readily available on the market and therefore the building does not entail excessive costs. The material can be made to look modern or old depending on the design of the building and the construction.

The construction methodologies and materials will be that of earth, concrete and brick work like the numerous methods being undertaken in the project area. All construction waste products such as cement wastes and broken bricks will be as much as possible used for backfilling on site and to a lesser extent transported to offsite designated dumpsites. This is attributed by the fact that the project will involve the construction and erection of several physical structures and infrastructure

No Project Option

The last option considered was the “No Project Option”. This option was found not to be appropriate as there will be no possibility to have the much-needed development to improve the aquaculture subsector in the country

Legal, Policy and Institutional Framework

The following institutional framework and relevant pieces of legislation were considered:

Legal framework

- a. The Fisheries Act N^o.22 of 2011;
- b. The Environmental Management Act N^o.12 of 2011
- c. The Environmental Impact Assessment (EIA) Regulation, SI 28 of 1997
- d. The Environmental Management (Licensing) Regulations, SI 112 of 2013
- e. The Lands Act (1995) and Land (Acquisition) Act cap 198 (1995);
- f. The Forest Act N^o. 4 of 2015;
- g. The Zambia Wildlife Act N^o. 14 of 2015;
- h. The Water Resources Management Act N^o. 21 of 2011;
- i. The Occupational Health and Safety Act N^o. 36 of 2010;
- j. The Employment Code Act N^o. 3 of 2019;
- k. The Public Health Act Cap 295;
- l. The Workers’ Compensation Act N^o. 10 of 1999;
- m. The Local Government Act of 2019;
- n. The Urban and Regional Planning Act, N^o. 3 of 2015;

- o. The Roads and Road Traffic Act, 2003;
- p. National Council for Construction Act, 2003;
- q. The Energy Regulation Act, 1995 & the Petroleum Act, Cap. 1995;
- r. The National Heritage and Conservation Act, 1998;
- s. The Animal Health Act N^o. 27 of 2010;
- t. The Food and Drug Act (Cap 303); and
- u. The Factories Act of 1999.
- v. The Fisheries Act, No 22 of 2011

Policy Framework

- a. Zambia National Aquaculture Strategy (NAS) 2014-2024;
- b. National Agriculture Development Policy (2004-2015);
- c. Seventh National Development Plan (7NDP 2017-2021);
- d. National Environmental Policy of 2006; and
- e. National Gender Policy.

African Development Bank (AfDB) Operational Safeguard Policies

The following AfDB Operational Safeguards (OS) are triggered:

- a. *Operational Safeguard 1: Environmental and social assessment:* This OS is triggered on account of the Project activities' potential to generate significant environmental and social impacts to identified receptors within the Project's area of influence;
- b. *Operational Safeguard 2: Biodiversity, renewable resources and ecosystem services:* This OS is triggered due to the potential effect on vegetation clearance as part of site preparation works in the project;
- c. *Operational Safeguard 3: Pollution prevention and control, hazardous materials and resource efficiency:* This OS is triggered due to the risk associated with the waste that are likely to be generated in the project including from the campsites and associated work; and
- d. *Operational Safeguard 4: Labour conditions, health and safety:* This OS is triggered on account of potential risks to worker health and safety during construction and operation of the ponds

International Environmental Conventions and Protocols to which Zambia is a Signatory, Food and Agricultural Organisation (FAO) Code of Conduct for Responsible Fisheries 1995; The Protocol on Fisheries for the Southern African Development Community of 2001; African Convention on the Conservation of Nature and Natural Resources, 1968; Southern African Development Community Best Practices and Management; Convention on Wetlands of International Importance, especially as waterfowl habitat 1971; The Convention on Biological Diversity, 1992; United Nations Framework Convention on Climate Change, 1992; and The Stockholm Convention on Persistent Organic Pollutants.

Institutional Framework

Institutions relevant to the development of the project include the following:

- a. The Zambia Environmental Management Agency;
- b. Kafue Town Council;
- c. Water Resources Management Authority;
- d. Department of Fisheries (Kafue District);
- e. Zambia Aquaculture Enterprise Development Project in the Ministry of Fisheries and Livestock.

POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

Positive Impacts

Contribute to improved diagnosis of fish for diseases: By and large, the project will contribute to improved delivery of fishery which is free and fit for human consumption as well as meet international market requirements especially in European Union markets. Through this, the fishery sector in the country will be competitive penetrating wider markets and earning competitive prices.

Enhanced safety of fish and its products: The planned ISO laboratory facility is poised to play a key role in food safety through array of its microbiological and chemical testing which will be important activities in ensuring food quality and safety through established rules, guidelines or characteristic activities aimed at achieving optimum degree of safety on the food and fish for human consumption needs. In addition, the operations of planned ISO food laboratory will deliver results on which important decisions are to be made at national level in Zambia regarding trade in the country's fisheries and associated products. Therefore, accreditation of the laboratory will enhance the public confidence in their test results and build the confidence in the products thereby increasing not only internal consumption of such products but also competitive entry into the international market.

Better containment of disease or exotic fish: The quarantine facility to be established under the project will serve to contain suspected disease fish or live fish samples for research in instances of suspected fish disease outbreaks.

Offer Short-term Employment opportunities: The project will offer short-term employment opportunities in terms of local/unskilled labour and construction-based support services through which those who get such engagements. It is estimated that about 150 people will benefit in the project in terms of short-term employment opportunities. This would be a positive to the local community but short-term in nature and can be enhanced through publicizing available project work opportunities in public areas such as administrative centres in and around Kafue areas. However, such work will be availed to those above 18 years of age.

Contribute to Additional Infrastructure to the fishery sector: Kafue Laboratory will comprise infrastructure delivering fishery research services and in that, it will be an added facility constituting the enhanced capacity of the sector in the country.

Sources of Income for Vulnerable Groups Especially Women: The project will be an avenue income to the women through sale of food items to the workers there by enabling them earn additional source income to support their families though this is to be a medium positive impact of short-term nature.

Source Income from Sale of local Construction Materials: The project will provide a source of income through supply of construction materials such as cement, sand, rock-based materials and hardware items. Through these, the locals stand to benefit from the project. It is recommended that,

extractable construction materials be sourced from suppliers who will be responsible for restoration of the sites and where the contractor directly extracts such materials, he/she will assume responsibility of ensuring acceptable restoration of the site.

Provision for a Much and Better Hands-on Human Resource in the Sector: With the construction and equipping of the new research laboratory facility, the Ministry of Fisheries and Livestock will have in-house, a facility to develop its human resources in the sustainable management of fisheries which is likely to occur through enhanced in-service training opportunities for the laboratory technical and support staff.

Project negative impacts

They will likely include:

Impacts relating to site preparatory works: These are basically pre-construction activities in terms of site preparation works, removal of waste and site levelling works, setting out new structures and removal of demolition debris amongst others. It is proposed that, works on the site be guided by the Resident Engineer to ensure works are done within the set out with his/her team which should include an Environmental Specialist. After project works, the construction areas should be restored and re-vegetated to the satisfaction of the Environment Officer of Kafue areas. In addition, the site will be secured with corrugated galvanize sheets.

Vegetation loss: This is likely to arise through site preparation works in which, vegetation on the site will be cleared alongside the lawn grass at the site. This is likely to a small-scale and localized/site based negative impacts includes trees are of ornamental nature/planted and the grass is also routinely maintained. These impacts will be mitigated by: restricting site clearance to mostly areas needed for infrastructure development and after works, the site be fully restored to allow for re-grassing with appropriate grass types alongside planting of ornamental plants with the guidance of Supervising Engineer and most important, the trees need not be planted close to foundations of buildings.

Impacts relating to sourcing of construction materials: Construction materials like stones, sand, etc. will have impact on the environment at their points of extraction including quarries sand burrow pits. This is a small-scale, low magnitude and localized negative impact. The study proposes that, the contractors to the extent feasible should obtain construction materials from existing suppliers who take obligation to ensure extraction sites are fully restored. However, where the contractor directly extracts construction materials from a site, then: such sites be properly leased and all dues agreed with land owners be paid fully; and the site be restored fully and area environment officer confirms and certifies that, restoration has been satisfactorily done before effecting any outstanding payments.

Erosion control concerns: This is likely to arise through site clearances and excavations works thereby exposing soil surfaces to rain and wind erosion though this will be a short-term, small-scale and minimal negative impact mainly occurring within the site. This can be mitigated through site restoration, planting of ornamental trees alongside rainwater harvesting measures. In addition, the project will put in place drainage channels to discharge storm water out of the facility and its environs.

Improper management of construction works: At each healthcare facility, renovation activities will involve demolition and construction activities that might generate considerable waste comprising brick and concrete rubble, metal, glass cullet and timber waste. Measures such as contractors undertaking waste segregation at source to separate hazardous from non-hazardous waste and construction waste such as metal scrap or wood waste which does not have any hazardous materials can be salvaged and handed to locals for various uses at household levels. In addition, the supervising engineers and area

environment officers should ensure that contractors do not illegally dump waste in non-designated areas. To effectively oversee this requirement, it is suggested that, area environmental officers should be facilitated to undertake active monitoring of works in the facilities.

Accumulation of cut-topsoil: Which is likely to arise through excavation works and general works to do with foundations at construction site which can be a source erosion and siltation. This is assessed as a medium negative impact whose implications can be mitigated through: re-use of the cut to spoil stuff for backfilling the foundations works with the approval of the Resident/Supervising Engineer. Any excess of such material can be transported and disposed at a site approved and agreeable with area environment officer.

Oils Pollution and Soil Contamination: To minimize the potential for environmental contamination at the construction site, oil products used in vehicles and tracks should be stored in secure facilities with impermeable concrete floors. In addition, waste/leakage oil should be contained in oil separators in the camps or workshops. This is a small-scale, localized but long-term negative impact with low chances of occurrences in the project.

Issues of non-or irregular payment of wages and salaries for the workers: The contractor has to provide the workers with contracts for their employment and such agreements should stipulate vividly terms and conditions of the employment and most important, what one is to earn, working terms, and implications. This is a medium negative impact and it is proposed that, it is to be mitigated through the project management co-opting the Kafue Labour Officer is to be part of monitoring team to ensure this requirement is observed.

Possible risks of engaging children in the project works: During the construction phase, the contractor is likely to engage children at construction sites as labourers which according to Zambian amounts to child labour and abuse and in contravention of the Child Statute as well as ILO policies. According to provisions of the Employment of Young Persons and Children Act of Cap 268 of the Employment Act of Zambia, no person shall, except under conditions to be prescribed, employ or cause to be employed, any person under the age of fifteen years. And any person who contravenes the provisions of this subsection shall be guilty of an offence.

Failure to cater for special user needs (esp. PWDs): The laboratory facility should be designed taking into account different user needs in terms of access and facilities inside. These will also include putting in place doors that can allow free movement of wheel chairs and toilets suited for people with disabilities (PWDs).

Occupational Health Safety (OHS) risks: Construction activities at the construction site have potential to pose occupational risks some of which could be life-threatening, for example, falling debris could injure workers if personal protective equipment (PPEs) are not provided or used. It is important, workers be provided with PPEs, on job tool-box talks in the mornings at the beginning of the day's work and putting in place, appropriate signage at the work sites as well as having well elaborate evacuation procedures to handle any emergency situations that may arise on the site.

Improper management of construction works: At laboratory construction sites, the works to be undertaken will likely generate considerable waste comprising brick and concrete rubble, metal, glass cullet and timber waste. Improper disposal of such construction waste could have environmental and public health impacts especially management of demolition rubble with possible friable construction materials. Contractors should undertake waste segregation at source to separate hazardous from non-hazardous waste as well as the supervising engineers and area environment officers should ensure that contractors do not illegally dump waste in non-designated areas. To effectively oversee this

requirement, it is suggested that, area environmental officers from Kafue should be facilitated to undertake active monitoring of works in the facilities.

Risks of HIV/AIDS-STI/STDs: The workers on the construction site can be prone to risks of Human Immuno Deficiency Virus/Acquired Immuno Virus/Sexually Transmitted Infections or Diseases (HIV/AIDS/STI-STDs). This can be triggered by workers getting on site and working alongside women. This can be mitigated by ensuring most local labour is sourced from within the project location to minimize risks of relocating labour from outside the project area. In addition, the contractor will liaise with an HIV/AIDS service provider who will conduct HIV/AIDS awareness sensitization as well as distribute condoms to the workers. Such a service provider will also conduct Voluntary Counselling and Treatment (VCT) services for the workers and distribute anti-retroviral (ARVs).

Waste to be disposed by a contracted waste handler: It is the responsibility of all laboratory staff to properly segregate laboratory waste because different types of wastes have different treatment standards. All waste in the laboratory will hence be laid in the waste bins as per bin labels. Improper and irresponsible disposal of chemical wastes down drains, to the Local Authority refuse collection, or into the atmosphere is forbidden by law.

Incineration: All other items that are deemed unsuitable to be put in the normal waste bins in the laboratories, will be placed in a special waste-bin supplied in each of the laboratories and such items include: broken laboratory glassware, sharp objects of metal or glass, dirty sample tubes or other items lightly contaminated with chemicals and such will all be incinerated (Figure 13). Incineration will also be used to dispose of used and expired laboratory reagents.

Risks of fires: Risks of fires in laboratories can be occasioned through spillages, irresponsible storage, handling and application of inflammable reagents, irresponsibly carrying around naked flames, smoking cigarettes and faulty electricity connections. All these will be addressed through Standard Operating Procedures (SOPs), having appropriate and functional fire extinguishers (Figure 14) and skills in firefighting. Laboratory staff be regularly subjected to fire/rescue drills amongst others.

Management of obsolete and expired reagents: The Kafue Laboratory is to have in place, guidelines for its management and disposal of expired and expired reagents in line with operational procedures for similar laboratory establishments and that could include every quarter (3 months), management of the laboratories prepare a list of materials which have expired. Good operational procedures for laboratories require that, Entities (Kafue Laboratory) should have measures to guide the purchase of its laboratories consumables in a manner that reduces wastage arising from unguided over-stocking resulting in mass expiry of consumables giving their challenge to be a burden.

Management of reagents spills: Normal laboratory operations are to have workable strategies for managing reagents spills and as part of their Standard Operating Procedures (SOPs). When a spill occurs, the area is cleared of any users, and the spill cleaned up immediately. Waste from spill clean-up is then disposed of appropriately depending on the kind of chemical. After floor spill, has been thoroughly cleaned up appropriately, the area is mopped dry to minimize the risk of slipping and falling. Emergency response procedures for laboratories.

Infectious spills (contained within a biological safety cabinet): When a spill of infectious material occurs within a BSC, a clean-up procedure should begin immediately, and the cabinet should continue to operate. Place absorbent tissue over the spill area and apply disinfectant solution liberally and if the walls of the BSC have been splashed, clean with a layer of absorbent paper towel liberally soaked in disinfectant solution. Leave affected areas covered with disinfectant for 30 minutes to 1 hour.

Carefully collect contaminated sharps material, and place in a puncture-resistant container for disposal. Any equipment or reusable material (for example, centrifuge buckets) that has been splashed should be cleaned with the same disinfectant, electrical equipment should be checked carefully before it is used; check the integrity of circuit breakers and earth-fault interrupters, and Collect other contaminated material in a sealed bag for appropriate disposal.

Environmental and Social Management Plan

An Environmental and Social Management Plan (ESMP) as well as Monitoring Plan have been prepared for this project, guided by requirements of Zambia Environmental Management Agency. The plans identify and summarize the potential impacts raised by the ESIA study, the mitigation measures which respond to each, and actions to be taken to the various parties assigned to the management and monitoring duties. This is to ensure successful implementation of the mitigation measures, parameter monitoring and subsequent audits.

Key parameters to be monitored during the lifecycle of the project will include:

- a. Water quality;
- b. Solid waste management;
- c. Fire preparedness and maintenance of fire equipment;
- d. Public health;
- e. Site security; and
- f. Soil quality.

Emergency Response Plan

An emergency response plan (ERP) has been developed for the project as part of the ESIA. The ERP includes strategies for notifications, assessment, coordination and prevention of emergencies during the project construction. Different emergency types have been identified, including evacuation situations, medical emergencies, fatal accident situations and structural failure emergencies. It is of utmost importance that the ERP will be updated throughout the project and will be fully implemented.

CONCLUSION AND RECOMMENDATIONS

- a. The proposed facilities are very vital in the support to the health and safety aspects in the marketing of fish both in the local market as well as export market. The international fish market (especially the European Union-EU) has very stringent fish standards which can be met by having in place, a laboratory of this scale to facilitate maintenance of standards in the fishery sector;
- b. The project once accomplished is well placed to support research in fish diseases thereby ensuring, the country fish is free of disease and fit for consumption. The project facility stands to support research into grey-areas in the science of fish thereby contributing to generation of a pool of knowledge needed for the growth of sector to meet protein growing needs in the country.
- c. Establishment of the Quarantine facility will offer control and confined environment to hold fish for management of suspected diseased fish for scientific observations during while investigations into such possible diseases’ outbreaks.
- d. That aside, it is also clear that, construction of these facilities will likely have negative environmental and social impacts which have been assessed to be of minimal negative scale and can be managed through implementation of the Environmental and Social Management Plan as well as Monitoring Plan;
- e. The project should provide a modest budget for construction on an Incinerator for hazardous laboratory waste management.



Signature: _____

Nelson Omagor
ESIA Team Leader
KCI in Association with JBN

Signature: _____

Name: _____

Title: _____

Ministry of Fisheries and Livestock
Mulungushi House
3rd Floor Mid and West Wing
P.O Box 50060, Lusaka

Zambia Aquaculture Enterprise
Development Project

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ACRONYMS

AfDB	African Development Bank
ARVs	Anti-Retro Virals
CBD	Convention on Biological Diversity
CBOs	Community-Based Organization
COHSMP	Contractor's Occupational Health and Safety Management Plan
COMESA	Common Market for Eastern and North Western Africa
DOF	Department of Fisheries
DWA	Department of Water Affairs
EHS	Environment Health and Safety
EMA	Environmental Management Agency
EMMP	Environmental Management and Monitoring Plan
EPF	Environmental Protection Fund
ERP	Energy Response and Preparedness Plan
EPB	Environmental and Social Impact Assessment
ESIS	Environmental and Social Impact Statement
ESMP	Environmental and Social Management Plan
GIDD	Gender in Development Division
GPS	Geographical Positioning System
GRZ	Government of the Republic of Zambia
ISS	Integrated Safeguards System
ISO	International Standards Organization
MCDSS	Ministry of Community Development and Social Services
MLGH	Ministry of Local Government and Housing
MMDA	Mine and Mineral Development Act
MoFL	Ministry of Fisheries and Livestock
MoFNP	Ministry of Finance and National Planning
MoH	Ministry of Health
NAS	National Aquaculture Strategy
NAPA	National Adaptation Programme of Action
NHCC	National Heritage Conservation Commission
OHS	Occupational Health and Safety
PAPs	Project Affected Persons
PPEs	Personal Protective Equipment
POPs	Persistent Organic Pollutants
PWDS	People with Disabilities
SNDP	Seventh National Development Plan
STDs/STIs	Sexually Transmitted Diseases/Sexually Transmitted Infections
TORs	Terms of References
VCT	Voluntary Counselling and Testing
ZEMA	Zambia Environmental Management Agency
ZESCO	Zambia Electricity Supply Corporation

GLOSSARY OF TERMS

Aquaculture	This is the farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants.
Aquaculture Park:	Refers to a concentration of fish production units in a suitable watershed that is well supplied with water; with appropriate environmental conditions for culture of the target species in terms of temperature, soil types, and terrain/topography. Aquaculture Parks are planned akin to the industrial parks concept.
Fish Cage	A cage is a structure that confines fish in an enclosure. Cage culture uses existing water resources (ponds, rivers, estuaries, open ocean, etc.) but confines the fish inside some type of enclosure. The enclosure retains the fish, making it easier to feed, observe and harvest them
Fish Pen	Fish Pen is an enclosure in the water for aquaculture made of netting on a frame; it serves to keep desired fish in and unwanted species out.
Cage fish culture:	This is the raising of fish in containers enclosed on all sides and bottom with mesh material that secures the fish inside while allowing relatively free water exchange with the surrounding environment.
Carrying Capacity,	the maximum number of cages or ponds that the environment can carry and sustain, considering its geography or physical features
Service Centre:	This is an integrated support system where fish farmers will access support from technical service providers, accessible and available sources of inputs, markets, financing, facilities and infrastructure (hatcheries, ice plant and cold storage, transport facilities
Stocking	the activity of supplying a stock of fish to the pond or cage
Stocking Density	Stocking density is the weight of fish per unit volume of water or the number of fish stocked at the beginning of a culture period
Farmer Cluster	Farmer clusters are defined geographical areas where there is voluntary or enforced agreement between all the producers for the management of fish health, environmental impact and escapes.
Farming	Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

The Zambia Aquaculture Enterprise Development Project (ZAEDP) is aimed at stimulating a viable aquaculture sub-sector in Zambia to promote economic diversification, food security and sustainable employment generation, all of which are central priorities of the Government of Zambia. The Project is expected to nurture a domestic aquaculture subsector which will serve as a viable and inclusive business opportunity, through enhanced production and productivity.

Although Zambia is endowed with natural water resources that offer significant opportunities to supply fish to meet its national demands, the growth in the Aquaculture and Fisheries sector has not matched the ever-increasing demand for fish, due to several reasons: Firstly, the Zambian capture fisheries sub-sector is operating at fully exploited or over-exploited levels. Capture fisheries will therefore, not be able to produce enough fish in Zambia to meet with the national demand. Secondly, aquaculture production has not been able to respond to the increase in demands of fish, because the quality and quantity of fingerlings produced in Zambia are low; there is a lack of dedicated fish feeds suppliers, and more importantly its business opportunities as a profit generating sector, has not been fully explored by the financial institutions because of the perceived associated risks

The commonly used species for aquaculture include the three spotted Tilapia (*Oreochromis andersonii*), the longfin tilapia (*Oreochromis macrochir*) and the redbreast tilapia (*Coptodon rendalli*). The Kafue river strain of the three spotted tilapia is the most commonly farmed species, particularly in the commercial sector, the Nile tilapia (*Oreochromis niloticus*), which is restricted to areas in Southern Zambia and some parts of Lusaka Province and is subject to the provisions of the Fisheries Act No 22 of 2011

With the volatility in copper prices in recent times, the need to diversify the economic base of Zambia becomes more compelling and indeed imperative. The Zambia Aquaculture Enterprise Development Project will promote inclusive economic development by targeting areas where fish farming is already an activity but has not been taken to its full economic and business potentials. To this end, the project will serve as bridge between the existing major players and medium to small scale producers through a customized out-growers scheme with technical assistance, feed fingerlings and finance. Targeted fish farmers are expected to improve their business and managerial skills and the quality of their productive systems to increase output, efficiently, while keeping fish prices affordable and meet growing demand from the lucrative domestic market.

The project development objectives will be achieved through:

- a. Support and promotion of reliable access to quality input and output markets;
- b. Competitively-priced risk sharing access to finance and
- c. Creation of an enabling infrastructure environment, which in turn is expected to facilitate the entry of new actors and expansion of business opportunities by the existing players in the industry.

The project seeks to ensure socio economic empowerment, increase the involvement of both genders in the advancement of the aquaculture sector in Zambia; create conditions for equitable access by men

and women to project resources and increase decision-making for women along the aquaculture value chain. Project interventions will thus deliberately target not less than 40% women and 20% youth as beneficiaries and will promote value addition that offers immense opportunities to increasing household income levels.

The Ministry of Fisheries and Livestock is implementing the project through its Project Implementation Unit (PIU), the Zambia Aquaculture Enterprise Development Project, in the areas of Chipepo (Lake Kariba), Samfya (Lake Bangweulu), Kasempa, Kafue, Rufunsa and Mungwi as well as in other high aquaculture potential zones. MoFL has engaged Kaizen Consulting International in association with JBN Consult and Planners to prepare an Environmental and Social Impact Statement (ESIS) necessary for meeting both Zambian statutory permitting requirements and Africa Development Bank Safeguard Standards.

1.2 PROJECT RATIONALE

The rationale for this intervention is premised on the fact that Zambia is endowed with abundant water resources, which support largely fresh water capture fisheries and in recent years, aquaculture. The potential of the major lakes of Tanganyika, Mweru-Luapula, Bangweulu, Kariba and Itezhi-tezhi (the latter two man-made) and major rivers of Zambezi, Kafue, Chambeshi and Luangwa as well as Lukanga swamps, which can readily support both capture and aquaculture fisheries development, have not been fully tapped. In addition, Zambia's National Aquaculture Strategy (NAS) 2014-2024, National Aquaculture Development Plan 2015–2020, National Agricultural Policy (NAP), Seventh National Development Plan (7NDP) and National Agriculture Investment Plan (NAIP), are all commitments by Government of Zambia to diversify its economy, by bolstering investments that will support the aquaculture sector to increase its contribution to the national economy. Growing the aquaculture sector will also assist the Government of Zambia to tackle the so-called “youth bulge” which is a manifestation of the growing “army” of unemployed youth. According to ILO data, Zambia's unemployment rate was 13.30% in 2013 and specifically youth unemployment rate stood 24.60% in the same year. The project will seek to create new jobs to ensure socio economic empowerment, amongst the youth particularly and women, by supporting them along the aquaculture value chain.

1.3 PROJECT DESCRIPTION

ZAEDP facilities to be constructed in Kafue are as follows: (i) Fish Ponds (Breeding, research, quarantine, production) 3000sq.m (ii) 1 Standard Food Safety Laboratory measuring 600 sq. m, (iii) 1 National Aquatic Animal Health Laboratories measuring 600 sq. m (iv) 1 indoor and outdoor quarantine laboratory measuring 300sq. m.

1.4 PROJECT PHASES

The project components will be implemented in four (4) phases that include:

1.4.1 PREPARATION PHASE

All the planning and designing related to the project, including budgeting, will be carried out during this stage. Additionally, ZAEDP will obtain permits or approvals from all relevant government institutions and agencies which include ZEMA, WARMA, DoF and Kafue Town Council.

1.4.2 CONSTRUCTION PHASE

This phase will include installation and construction of physical buildings/infrastructure such as accommodation, offices, hostels. This phase of the project will create a considerable number of job opportunities for locals.

1.4.3 OPERATION PHASE

Operationalisation (equipment & personnel) of ISO compliant Food Safety Laboratory.

1.4.4 DECOMMISSION AND CLOSURE PHASE

Aquaculture developmental projects are usually temporary in nature and after a certain period of operation, the ponds and associated infrastructures will be decommissioned and the sites closed. It will be important that activities during this phase are carried out in an environmentally sound manner, leaving as little impact as possible on the environment. To this end, a decommissioning and closure will be developed. The main objectives of the plan will be to:

Promote alternative economic activities in the area that are sustainable in the future;

Ensure the safety of surrounding communities through public consultation and the erection of warning signs. Return the land to conditions capable of supporting the former land use, or where this is not practical, or feasible, an alternative sustainable land use; and Prevent potential significant adverse effects on adjacent environs. Where possible, the Department of Fisheries will ensure that progressive rehabilitation is undertaken so that the rate of rehabilitation is like the rate of project operations

1.5 PROJECT TEAM CONTEXT

<p>Contact Person Dr Alexander Shula Kefi The Project Coordinator Zambia Aquaculture Enterprise Development Project Email: askefi@yahoo.com +26079255620/+26069426244</p>	<p>Physical Address The Project Coordinator Zambia Aquaculture Enterprise Development Project Contact Person Reedbuck Road, Plot No.13A, Kabulonga, Lusaka, Zambia.</p>
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1.6 PARTICULARS OF SHAREHOLDERS/DIRECTOR

Government of the Republic of Zambia.
Ministry of Fisheries and Livestock

Mulungushi House
3rd Floor Mid and West Wing
P.O Box 50060, Lusaka

1.7 TRACK RECORD

The mission of the MoFL is to facilitate and support the development of sustainable, diversified and competitive fisheries and livestock sectors that assure food and nutrition security, contribute to job creation and maximise profits and the sector's contribution to Gross Domestic Product. The Mandate of the Ministry of Fisheries and Livestock is anchored on Government Gazette Notice N^o. 183 of 2012. Its portfolio functions include; Animal Health, Fisheries and Aquaculture Research, Livestock and Veterinary Research, Veterinary and Fisheries training, Fisheries and Livestock Extension, Livestock Identification and Traceability, Dairy Industry Development, Fisheries and Management Development, Livestock Development, Tsetse Control and ecology. Table below shows a portfolio of projects that the MoFL has successfully undertaken recently.

Table 1: Ministry of Fisheries & Livestock Project Portfolio

Global Alliance for Livestock Veterinary Medicine	Agriculture Productivity and Market Enhancement Project (APMEP)
<p>Objective: To evaluate Contagious Bovine for Pleuro-Pneumonia ben-1 vaccine as well as evaluate the use of anti-micromicals to treat CBPP.</p> <p>Location: Country wide</p> <p>Start Date: 2013</p> <p>End Date: 2018</p> <p>Funding Agency: United Kingdom/Bill and Melinda Gates Foundation.</p> <p>Project Beneficiaries: Ministry of Fisheries and Livestock, Livestock farmer households afflicted by CBPP</p>	<p>Objective: The sector goal is to contribute to economic growth and food security. APMEP's objectives are to contribute to economic growth and poverty reduction by enhancing food, income and nutrition security, among participating households.</p> <p>Location: Serenje, Choongwe, Chitambo, Sinaziongwe and Kasempa</p> <p>Start Date: 2014</p> <p>End Date: 2018</p> <p>Funding Agency: African Development Bank (ADB)</p> <p>Project Beneficiaries: Small holder Farmers</p>
Livestock Development and Animal Health Project. (LDAHP)	Livestock Infrastructure Support Project (LISP)
<p>Objectives: To improve the productivity of key livestock production systems for both women and men targeted smallholder producers in identified areas.</p> <p>Location: Country wide</p> <p>Start Date: 2012</p> <p>End Date: 2018</p> <p>Funding Agency: World Bank (IDA)</p> <p>Project Beneficiaries: Smallholder Livestock produce</p>	<p>Objective: To improve smallholder livestock production, productivity, create market linkages and increase incomes of livestock farmers.</p> <p>Location: 9 Districts in North Western and Muchinga Provinces</p> <p>Start Date: 2013</p> <p>End Date: 2018</p> <p>Funding Agency: African Development Bank</p> <p>Project Beneficiaries: Smallholder livestock keeping households</p>
Enhanced-Smallholder Livestock Investment Project (E – SLIP)	FMD Viral Disease Management Programme
<p>Objective: Sustainably improve incomes of rural poor households in targeted provinces and districts. Improved production and productivity of</p>	<p>Objective: To sample a statistically significant sample of cattle herds in a Zambian region in order to characterize the FMD profile in the</p>

Global Alliance for Livestock Veterinary Medicine	Agriculture Productivity and Market Enhancement Project (APMEP)
<p>key livestock systems of targeted female and male smallholder producers in all the provinces in Zambia</p> <p>Location: Country wide</p> <p>Start Date: 2015</p> <p>End Date: 2021</p> <p>Funding Agency: GRZ, IFAD, OFID AND BENEFICIARIES</p> <p>Project Beneficiaries: Smallholder livestock keeping farmers in Zambia</p>	<p>specific region. To use CSIR developed method of total disease management and evaluate its possible implementation in Zambia context for subsequent adoption pending current program success.</p> <p>Location: Country wide, but biased toward Livestock farmers affected with FMD (Foot and Mouth Disease)</p> <p>Start Date: 2015</p> <p>End Date: 2019</p> <p>Funding Agency: SIDA/ Bill and Melinda Gates.</p>
Zambia Dairy Transformation Programme	Climate Resilient Livestock Management Project
<p>Objective: To advance the aquaculture sub-sector as a viable and inclusive business opportunity, through enhanced production and productivity, in order to improve the livelihoods of beneficiaries along the aquaculture value chain.</p> <p>Location: Countrywide in high potential zones.</p> <p>Start Date: 2017</p> <p>End Date: 2022</p> <p>Funding Agency: African Development Bank</p> <p>Project beneficiaries: Fish farmers and entrepreneurs of which 50% are women in high potential targeted regions/zones</p>	<p>Objective: To build climate resilient in the Livestock Infrastructure Support Project</p> <p>Location: 9 Districts in North Western and Muchinga Provinces</p> <p>Start Date: 2017</p> <p>End Date: 2020</p> <p>Funding Agent: African Development Bank</p> <p>Project Beneficiaries: Smallholder Livestock farmers.</p>

1.8 TOTAL PROJECT COST/INVESTMENT

The total project cost is **USD 1.8 million**. The project will run for five years starting from 2017-2022.

1.9 IMPLEMENTATION DATE AND LIFE SPAN

The Zambia Aquaculture Enterprise Development Project is expected to be implemented as soon as the decision letter is issued by ZEMA and other relevant permits are obtained. The project is expected to run for five years starting from 2017-2022.

1.10 STUDY METHODOLOGY

The study was undertaken to obtain the views and concerns of the interested and affected parties i.e. local authority and authorizing agencies. The following steps were involved in the process:

- a. Consultation with the local authority, stakeholders who would have an interest in the project;
- b. Review of relevant legislation;
- c. Review of environmental literature;
- d. Identification of significant environmental impacts and development of mitigating measures.
- e. Responses from consultations and data from literature provided information on identification of significant environmental impacts and helped in the development of an environmental management and monitoring plan.

2 POLICY, LEGISLATION AND INSTITUTIONAL FRAMEWORK

A number of pieces of legislation are relevant to the proposed project and it is the incumbent upon the developer to comply fully with the provisions of all applicable legislation. Legislation which is principally to the project and which plays a part in the way the project is planned, implemented and operated is identified in this section in order to highlight areas of concern and to assist in the understanding of why certain options are preferred over others. Numerous aspects of legislation including policy and administrative framework have also been discussed.

2.1 POLICY FRAMEWORK

2.1.1 NATIONAL ENVIRONMENTAL POLICY 2006

In 2006 the National Environmental Policy was adopted by government, which provided for environmental management in the country and provided policy framework under which provisions of the Environmental Management Act (EMA) were drafted.

2.1.2 NATIONAL DECENTRALIZATION POLICY

The National Decentralization Policy (developed in 2002, launched in 2004) aimed at decentralizing government responsibilities and functions to lower level government through “devolution”. It reaffirms the local authorities as the institutions responsible for water supply and sanitation.

2.1.3 NATIONAL WATER POLICY 2007

The National Water Policy of 2007 aims at promoting a sustainable water resources development with a view to facilitate an equitable provision of adequate quantity and quality of water for all competing groups of users at acceptable costs and ensuring security of supply under varying conditions. This entails establishing a well-defined institutional structure that will achieve the intended policy objectives.

2.1.4 SEVENTH NATIONAL DEVELOPMENT PLAN – 2017 – 2021-(7NDP)

The Seventh National Development Plan – 2017-2021 (7NDP) forms the latest and significantly reoriented national development plan. It is closely aligned to contributing to the United Nations Sustainable Development Goals (SDG) known as the Global Goals. Within this five-year development framework, the ZAED will address at least to two planned outcomes of the 7NDP: to invest in economic diversification away from mining and to support employment generation and poverty reduction in rural areas. Given the relatively low levels of development in northern (in case of Mungwi), Luapula (in the case of Samfya) Zambia, and especially in the Mungwi, Samfya, Gwembe Districts, this project can be expected to have considerable transformative effects; particularly contributing to strategies 3, 4 and 6 of 7NDP Development Outcome 1 for a diversified and export-oriented agriculture sector. The project is also well aligned with the 7NDP intentions for economic sectors to align their programmes and strategies to contribute to the Plan’s overarching objectives and for decentralization of decision-making to provinces and districts through a clustering approach; gathering and applying resources in an integrated manner.

2.1.5 THE NATIONAL AQUACULTURE DEVELOPMENT STRATEGY (2004)

The National Aquaculture Development Strategy (2004) provides the strategic framework for the development objectives of the sub-sector. The NADS seeks to promote an enabling environment to attract private sector-led growth in order to attain increased domestic fish production. The National Aquaculture Strategy of Zambia considers the development of contractual partnerships between small scale fish farmers and commercial aquaculture companies such as for cage aquaculture as a key criterion to increasing national aquaculture development. By forging such a relationship smallholder fish farmers benefit through access to markets, feed, seed and capital.

Presently, there is little smallholder fish cage aquaculture around Lake Bangweulu. This is predominately because the community lacks technical know-how and capital. Furthermore, these limitations are compounded by lack of a reliable source of high-quality fingerlings, affordable and high-quality fish feed, good quality and affordable cages and difficulties of access to markets.

Targeted fish farmers are expected to improve their business and managerial skills and the quality of their productive systems in order to increase output, efficiently, while keeping fish prices affordable and meet growing demand from the lucrative domestic market.

2.1.6 NATIONAL AGRICULTURE POLICY 2012-2030 (REVISED)

In line with the implementation period for the national Vision 2030, the revised NAP 2012-2030 shall be implemented from 2012 to 2030. Over this period, the agricultural sector will strive to make maximum contribution to the macro targets that have been specified in the national vision by *A Prosperous middle-income nation by 2030*. Regarding fisheries, the NAP 2012-2030 envisages to continuously improve agricultural input and product markets so as to reduce marketing costs and increase profitability and competitiveness of agribusiness. Furthermore, continuously strengthen public and private sector institutional capabilities to improve agricultural policy implementation, resource mobilization, agriculture research, technology dissemination, and implementation.

2.1.7 NATIONAL GENDER POLICY OF 2000

In the year 2000, government launched the National Gender Policy which serves as a gender mainstreaming institutional framework for government ministries. In the year 2006, the government established the Ministry of Women's Affairs which was later changed to Ministry of Gender and Development to oversee the gender mainstreaming activities in the country. Specifically, in the project, its implementation will take deliberate measures to mainstream gender in terms of employment opportunities for the women as well as project facilities ought to separate for men and women in the Centre.

2.2 AFRICAN DEVELOPMENT BANK (AFDB) OPERATIONAL SAFEGUARD POLICIES

The African Development Bank has published its Integrated Safeguards System (ISS) which is designed to promote the sustainability of project outcomes by protecting the environment and people from the potentially adverse impacts of projects. The Bank's Operational Safeguards include:

Table 2: African Development Bank Operational Safeguard Policies

Bank Operational Safeguards	Provisions
Operational Safeguard 1	Covers the need to conduct an environmental and social assessment based on the category and level of anticipated impacts on the project.
Operational Safeguard 2	Consolidates policy commitments and requirements set out in the Bank's policy on involuntary resettlement.
Operational Safeguard 3	Is focused on biodiversity and ecosystem services which aims to conserve biological diversity and promote the sustainable use of natural resources.
Operational Safeguard 4	Addresses pollution prevention and control, hazardous materials handling and resource efficiency with a focus on pollution prevention including mitigating effects of greenhouse gas.
Operational Safeguard 5	Focused on labour conditions, health and safety requirements for workers' conditions, rights and protection from abuse or exploitation.

2.3 LEGAL FRAMEWORK

2.3.1 ENVIRONMENTAL MANAGEMENT ACT, N^O. 12 OF 2011

The principal legislation governing environmental management in Zambia is the Environmental Management Act (EMA) of 2011. The Act provides for the sustainable management of natural resources and protection of the environment, and the prevention and control of pollution and establishes and empowers the Zambia Environmental Management Agency to carry out demand for environmental assessments for projects, to carry out monitoring and inspections.

Relevance: Of particular relevance to ZAEDP is Section 29 of the Act which states that “A person shall not undertake any project that may have an effect on the environment without the written approval of the Agency, and except in accordance with any conditions imposed in that approval”. This has necessitated preparation of this Project Brief to key out impacts of the project and put in place, mitigation measures.

Compliance: The EPB report for the ZAEDP is being prepared before the construction works begin.

2.3.2 THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REGULATIONS, SI 28 OF 1997

The Environmental Impact Assessment (EIA) Regulations, Statutory Instrument (SI) 28 of 1997, demands that before a developer commences implementing a project, an EIA report must be prepared and submitted to the relevant regulatory authority for review and approval.

Relevance: According to the Second Schedule of the EIA Regulations, the proposed ZAEDP project falls within the following categories which require that an Environmental Assessment to be undertaken and submitted for approval.

Compliance: This Project Brief has been prepared for ZEMA’s approval before undertaking any implementation works.

2.3.3 THE ENVIRONMENT MANAGEMENT (LICENSING) REGULATIONS (SI 112 OF 2013)

There are several parts in this SI giving regulatory powers to ZEMA to control the discharge of water pollutants, air emission pollutants, pesticides and other toxic substances, waste (both municipal and hazardous) and ozone depleting substances. Part II of these Regulations in particular, gives powers to ZEMA to regulate discharge of water pollutants and emission of air pollutants into the atmosphere in order to safeguard the general health, safety or welfare of persons, animal life, and plant life.

Relevance: The SI also governs the discharge of any wastewater that may be produced at any stage of the project. In this case, it is envisaged that there will be effluent that will be discharged from the laboratories and the processing facilities into on-site treatment facilities, chemical waste will be collected in waste tanks and discharged off in gazetted areas by qualified professional.

Compliance: Regular monitoring of water and the surrounding environment by ZAEDP environmental officers to monitor effluents from these facilities.

2.3.4 THE FISHERIES ACT, NO. 22 OF 2011

The Fisheries Act provides for the development of commercial fishing, enforcement of fishing regulations and laws such as fishing ban. The Act also identifies aquaculture as a viable means of

fisheries development in Zambia and promotes environmental stewardship and application of international codes on good aquaculture practices in line with the SADC Protocol on fisheries. The Act further provides for the setting of fisheries management areas for capture fisheries. For aquaculture development, the Act demands carrying out an Environment Impact Assessment (EIA) for all large-scale aquaculture activities and provides for prohibitions and penalties for offences and omissions.

Relevance: *This* is an undertaking that is controlled by the provisions of this Act. Although the aquaculture regulations have not yet been developed, the Act demands that before any large-scale aquaculture license is issued, an Environment Project Brief should be undertaken in accordance with the provisions of the EMA.

Compliance: ZAEDP has complied with this condition through the preparation of an Environmental Project Brief Report before construction begins and throughout the project, all requirements as set out in the environment brief and the Act will be followed.

2.3.5 THE URBAN AND REGIONAL PLANNING ACT, NO. 3 OF 2015

This piece of legislation was developed, among others reasons, to establish procedures for integrated urban and regional planning in a devolved system of governance so as to ensure multi-sector cooperation, coordination and involvement of different levels of ministries, provincial administration, local authorities, traditional leaders and other stakeholders in urban and regional planning. It also seeks to ensure sustainable urban and rural development by promoting environmental, social and economic sustainability in development initiatives and controls at all levels of urban and regional planning.

Relevance: The Act provides for the appointment of regional planning authorities, provincial planning authorities and local planning authorities whose main responsibilities are the preparation, approval of layout plans and revocation of development plans.

Compliance: The project site layout plans will need to be approved by Kafue Town Council in consultation with the Lusaka Provincial Planning Authority before construction can commence in accordance with the planning guidelines and framework set by the authorities. Department of Fisheries will also recognize the jurisdiction of the Southern Province planning authority and its specifications will be complied with.

2.3.6 THE LANDS ACT, NO. 27 OF 1995

The Lands Act is the statute governing land administration in Zambia which vests all land in the Country in the President and alienation of land by the President. The Act gives Zambians an opportunity to participate in the country's economy. The Minister responsible for lands has also issued Land Circular N^o. 1 of 1985.

Relevance: The piece of land where the project will be set up is currently in private hands and belongs to Department of Fisheries. The site is 2.5ha.

Compliance: The Department of Fisheries complied with this Act has it followed all the right channels to acquire the land.

2.3.7 THE LOCAL GOVERNMENT ACT, NO. 2 OF 2019

The Act provides for the establishment of Councils in districts, the functions of local authorities and the local government system. Some of these functions relate to pollution control and protection of the

environment in general and the main functions of the Public Health Department of the local authority include solid waste management, food control services; and disease control.

Relevance: The ZAEDP will be implemented in Kafue District and Kafue Town Council is empowered by the Local Government Act to make bye-laws which are expected to be observed by developers (including ZAEDP) and residents of the district.

Compliance: Department of Fisheries will recognise the authority of the local authorities and will be expected to comply with the specifications and any relevant by laws set up by the affected local authorities.

2.3.8 THE PUBLIC HEALTH ACT (STATUTORY INSTRUMENT NUMBER 22 OF 2020)

The Public Health Act (Infected Areas) (Corona Virus Disease 2019) Regulations provides among many others the definition of Covid-19, conveyance, infected area, and unsanitary conditions.

Relevance: The project will be employing different types of people from different backgrounds and locations where the disease might have occurred thereby causing a serious threat of catching the disease to other workers who may not have been exposed to the disease.

Compliance: ZAEDP will ensure compliance to all the provisions of the statutory instrument in order to ensure the health of all the employees on the project site.

2.4 THE FORESTS ACT, NO. 4 OF 2015

The Forest Act, which repealed the Forests Act of 1999, provides for the establishment and declaration of National Forests, Local Forests, joint forest management areas, botanical reserves, private forests and community forests; provide for the participation of local communities, local authorities, traditional institutions, non-governmental organisations and other stakeholders in sustainable forest management; provide for the conservation and use of forests and trees for the sustainable management of forests ecosystems and biological diversity; and establish the Forest Development Fund.

Relevance: The construction of the Aquaculture Park in Kafue District will entail the clearing of existing vegetation an activity that has to be undertaken in cognizance of the provisions of this Act.

Compliance: Department of Fisheries will not allow unnecessary cutting down of vegetation as well as disposal of cut vegetation through burning.

2.4.1 THE WATER RESOURCES MANAGEMENT ACT, NO. 21 OF 2011

The Water Resources Management Act No.21 of 2011 establishes the institutional regulatory framework including the creation of; the Water Resources Management Authority (WRMA), Catchment Councils and Water Users Associations in line with decentralised governance system. The Act sets water quality standards in collaboration with ZEMA and the Zambia Bureau of Standards (ZABS) and provides for mandatory EIA for large scale and sensitive projects as would be deemed so by the Authority and ZEMA.

2.4.2 THE EMPLOYMENT ACT, NO. 15 OF 2015

This Act provides legislation relating in particular to, the employment of persons; to make provision for the engagement of persons on contracts of service and to provide for the form of and enforcement of contracts of service. According to this law, it is illegal for any employer to engage an employee on casual basis for any job that is of a permanent nature. The Act also bans unjustified termination of employment by employers.

Relevance: The construction and operation phases of the project will involve the employment of skilled and unskilled manpower and their engagement should be in compliance with the provisions of this Act.

Compliance: Department of Fisheries will ensure that individuals employed at the project are above years of age and are provided with conditions of service that meet or exceed the minimum conditions of service. Employees will not be subjected to exploitation and abuse of their rights through casualization.

2.4.3 THE WORKERS COMPENSATION ACT, NO. 10 OF 1999

This Act makes provision for the establishment and administration of a Fund for the compensation of the disabled by accidents to, or diseases contracted by, such Workers in the course of their employment, and for the payment of compensation to dependents of Workers who die as a result of such accidents or diseases; for the payment of contributions to such Fund by employers; for the grant of pensions and allowances to certain dependents of Workers who, being in receipt of pensions for such disablement, die from causes not connected with such accidents or diseases.

Relevance: ZAEDP will create more than 100 job opportunities and work will involve the use of machinery and equipment that may cause injury to workers during their use or operation.

Compliance: The contractor to be engaged to execute the project will make contributions to the Fund on behalf of the workers. In the event of any injury to any person, due compensation shall be provided. Companies being contracted shall also be expected to show certificate of contributions made to the Fund.

2.4.4 THE OCCUPATIONAL HEALTH AND SAFETY ACT, NO. 36 OF 2010

This Act is promulgated to provide for the health, safety and welfare of persons at work; provide for the duties of manufacturers, importers and suppliers of articles, devices, items and substances for use at work; provide for the protection of persons, other than persons at work, against risks to health or safety arising from, or in connection with, the activities of persons at work. Section 11 of Part III requires that an employer of ten or more persons at any workplace establishes a health and safety committee. According to section 13 the functions of the health and safety committee which among others is to promote cooperation between the employer and the employees in achieving and maintaining healthy and safe working conditions and share information about occupational health, safety and welfare with employees. Investigate and resolve any matter that may be a risk to the health and safety of employees at a workplace.

Relevance: The operation of the project might raise the risks of occupational health hazards as a result of the use and operation of machinery and tools and the handling of feeds and chemicals. The generation of dust from clearing activities is another occupational health risk that will be generated by the project.

Compliance: Department of Fisheries will ensure that all the workers are provided with adequate and appropriate personal protective equipment and also provide information, instruction, training and supervision to ensure the health and safety of the employees at their workplace.

2.4.5 THE PUBLIC HEALTH ACT, NO. 22 OF 1995

This Act provides for the prevention and suppression of diseases and the general regulation of all matters connected with public health in Zambia. Amongst other things, the Act prohibits anyone from causing a nuisance, where nuisances are given to include amongst others, any collection of water or any cesspit, latrine or urinal found to contain mosquito larvae. In addition, any collection of water, sewage or waste which permits or facilitates the breeding of parasites, insects or other agents which may lead to the infection of people or domestic animals.

Relevance: Temporary residential places will be erected during the construction period while permanent structures will be constructed and used during the operational phase. Along with these structures will be public convenience places for the workers. Water of adequate quantity and quality will be required for domestic consumption.

Compliance: Management will ensure that the project site and more importantly the construction camps and subsequently the operational areas exhibit high levels of hygiene in order not to subject workers and the general public to public health nuisances. The project site will, at all times, be kept in clean and sanitary conditions.

2.4.6 THE FACTORIES ACT, 1999

The Act regulates the conditions of employment in factories and other places of work as regards the safety, health and welfare of persons employed therein. The Act also provides for the examination and inspection of certain plant and machinery in order to ensure safety. The Factories Inspectorate under the Ministry of Labour and Social Security is the mandated authority under the Act.

Relevance: All places of work as defined under this act will be deemed a ‘factory’ where safety, health and general welfare of employees will be required to be upheld.

Compliance: To ensure that the occupational health and safety of employees is upheld during the construction and operational periods, all employees will be trained in health and safety protocols. All employees will be equipped with adequate and appropriate personal protective equipment and the devices, tools and equipment that will be used by the employees will be regularly inspected, maintained and repaired if found to be defective.

2.4.7 THE NATIONAL HERITAGE CONSERVATION COMMISSION (NHCC) ACT, NO. 13, OF 1994

The NHCC Act provides for the conservation of ancient, cultural and natural heritage, relics and other objects of aesthetic, historical, pre-historical, archaeological or scientific interest.

Relevance: Preliminary surveys indicate that the project site does not have any artefact of historical or archaeological value.

Compliance: The baseline study included a survey of archaeological, historical and geological artefacts. In the event that any artefact is found at the project site, National Heritage and Conservation Commission (NHCC) will be notified.

2.4.8 THE ANIMAL HEALTH ACT NO. 27 OF 2010

The Animal Health Act N^o. 27 of 2010 establishes the Livestock Department and provides for livestock hygiene standards, control of movement of livestock for purposes of diseases control, the control of movement and importation of animals including fish. In collaboration with other regional and international veterinary authorities provides for issuance of permits for livestock and animals.

Relevance: The operation of an aquaculture project has potential to be a public health nuisance thereby endangering the health and life of livestock.

Compliance: The Act controls the importation and movement of fish and the site shall at all times be kept in sound sanitary conditions so as not to endanger the life of fish.

2.4.9 FOOD AND DRUG ACT (CAP 303)

The Food and Drugs Act was prepared to protect the public against health hazards and fraud in the sale and use of food, drugs, cosmetics and medical devices.

Relevance: Provisions for marketing of fish intended for human consumption are contained in the Food and Drug Act (Cap 303). However, there is no mention of fish products of aquaculture origin. The law appears to consider fish in general without distinguishing their origin. Similarly, measures for disposal of dead fish material or waste from any aquaculture facility operated by the licensee including consents and notifications required in respect thereof are needed.

Compliance: The Act prohibits selling of any food that is unfit for human consumption because it is poisonous or has harmful substances, is filthy, rotten, decomposed or diseased or has foreign matter, or is adulterated. The Act also requires that food is sold, prepared, packaged or stored for sale according to the required standards and that this is done under sanitary conditions. Department of Fisheries will ensure that quality control is incorporated into the production process from receipt of the brooding stock, through the rearing, harvesting and processing steps up to the time the fish will be ready for sale.

2.4.10 ROADS AND TRAFFIC ACT NO. 2 OF 2011

The Act makes provision for the care, maintenance and construction of roads in Zambia, for the control of motor traffic, for the licensing of drivers and motor vehicles, for the compulsory third party insurance of motor vehicles, for the licensing and control of public service vehicles and public services, and for other miscellaneous provisions relating to roads and motor traffic.

Relevance: The proposed development will involve the rehabilitation of approximately 40km feeder roads for which the construction, care and maintenance should be according to this Act. When the proposed development is complete there will be an increase in traffic that should be controlled to ensure that the roads are safe for all road users.

Compliance: The developer will ensure that the road design and construction is done by quality and registered engineers who will take into consideration provisions of this Act. All signs and directions to control traffic movement and ensure a safe environment will be put in place. The proponent also plans to expand the road reserves (road width) to promote safety for pedestrians and have adequate storm water drains.

2.4.11 THE NATIONAL PENSIONS SCHEME ACT NO.7 OF 2015

Section 3 of this Act stipulates the formation of the National Pension Scheme Authority, which is a body corporate with perpetual succession and a common seal, capable of suing and being sued in its corporate name, and with power subject to the provisions of this Act, to do all such acts and things as a body corporate may by law do or perform. Some of the key responsibilities of NAPSA are; registration of employers and employees, collection of contributions, enforcement of compliance, and investment of funds not immediately required for payment of benefits, processing of claims and payment of benefits and education of members.

Relevance: The proposed development project is being implemented by Ministry of Fisheries and Livestock through ZAEDP which is guided by the provisions of this Act.

Compliance: The Department of Fisheries as the monitoring agency of the project will ensure that all employees that will have any job on this project will be registered and paid up on their contributions to NAPSA.

2.4.12 NATIONAL COUNCIL FOR CONSTRUCTION ACT NO. 13 OF 2003

An Act to provide for the establishment of the National Council For Construction and to define its functions :to provide for the promotion and development of the construction Industry in Zambia; to provide for the registration of contractors; to provide for the affiliation to the Council of professional bodies or organizations whose members are engaged in activities related to the construction Industry; to provide for the establishment of the Construction school; to provide for the training of persons engaged in construction or in activities related to construction; and to provide for matters connected with or incidental to the fore-going.

Relevance: The proposed development will involve construction works and all construction workers/contractors will have to be registered with the National Council for Construction.

Compliance: All construction contractors to be engaged on the project will be registered and compliant with the National Council for Construction terms and conditions.

2.4.13 THE STANDARDS ACT NO. 4 OF 2017

This is an Act to continue the existence of the Zambia Bureau of Standards and re-define its powers and functions; provide for standardization and quality assurance of products and services through the setting of national standards and provision of conformity assessment services for products and services; repeal the Standards Act, 1994; and provide for matters connected with, or incidental to, the foregoing.

Relevance: The development will require that material (pipes, sand, stone, food stuffs, machinery and other finished material) be transported to the site.

Compliance: All raw materials and pipe works procurement and all designs and layouts will be in compliance with the Zambia Bureau of Standards.

2.4.14 THE ZAMBIA WILDLIFE ACT NO. 14 OF 2015

Section 4 among others states that wildlife shall be conserved and managed as an asset for present and future generations and to achieve economic growth. Section 18 (1) States that a person who enters into or resides in, or purports to enter into or reside in, a National Park or Community Partnership Park commits an offence. Section 23 (1) A person who, without the written consent of the Director, introduces any vegetation or causes any vegetation to be introduced into a National Park, Community Partnership Park or bird or wildlife sanctuary, commits an offence. Section 26. Except as is otherwise provided by this Act, a person commits an offence who, without the relevant license or permit, is in possession of, kills, injures, captures or disturbs a wild animal or removes or destroys an egg, a nest or habitat of a bird, reptile or fish within the confines of a National Park, Community Partnership Park, bird or wildlife sanctuary or Game Management Area.

Relevance: The existing ecosystem within the project area has potential for existence of wild animals although most of the big animals have migrated from the area due to human activities.

Compliance: ZAEDP and its contractors will comply with the relevant provisions under this Act in order to protect wild life resources of significance in the project area.

2.5 INTERNATIONAL ENVIRONMENTAL CONVENTIONS AND PROTOCOLS TO WHICH ZAMBIA IS A SIGNATORY

Zambia is not alone in the world hence has the mandate to ensure that all activities being implemented within the country do not only comply with the local legislation but also fits well with international requirements.

2.5.1 THE PROTOCOL ON FISHERIES FOR THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY OF 2001

The Protocol seeks to promote responsible and sustainable use of the living aquatic resources and aquatic eco- systems (eco-systems approach) in order to enhance food security and human health. The specific policy objectives are to promote effective management of fish stocks, protect and preserve fish resources, promote aquaculture and promote trade in fish. The Articles relevant to this include but not limited to Articles 2, 3, 4, 5, 13 and 14.

Relevance to the project. Development of Aquaculture and its promotion is intended to provide alternative livelihoods to the rural communities thereby contributing to responsible and sustainable utilisation of aquatic resources in capture fisheries environment.

Compliance: ZAEDP will work towards successful in compliance with the protocol.

2.5.2 AGREEMENT ON THE ACTION PLAN FOR THE ENVIRONMENTALLY SOUND MANAGEMENT OF THE COMMON ZAMBEZI RIVER SYSTEM, 1987

The Plan promotes sustainable development and wise use of resources and in particular to this project, the water resources.

Relevance to this project: The integrated management of the water resource is key principle.

Compliance: The project will work in line with the requirements provided in the agreement.

2.5.3 REVISED SOUTHERN AFRICAN DEVELOPMENT PROTOCOL ON SHARED WATER COURSES

The Protocol seeks to harmonies the utilisation and development of water resources within the SADC Region. Integrated development and sustainable use of water resources is promoted. Prior Informed Consent principles are implied.

Relevance to the project is the need to get prior informed consent from the other country sharing the water resources.

Compliance: ZAEDP will comply with the provisions and requirements of the protocol

2.5.4 AFRICAN CONVENTION ON THE CONSERVATION OF NATURE AND NATURAL RESOURCES, 1968

The agreement supports and promotes conservation of biodiversity such as is on Lakes and Rivers. ZAEDP will adhere to mitigation measures especially as relates to escapes to avoid anthropogenic induced single species dominancy.

Relevance to the Project: Soil protection, water protection and protection of flora and fauna is an obvious impact to the project.

Compliance: The project will ensure that provisions in this convention are followed and adhered to.

2.5.5 CONVENTION ON WETLANDS OF INTERNATIONAL IMPORTANCE, ESPECIALLY AS WATERFOWL HABITAT, 1971

The principles for wetlands management are relevant to the sites as wetlands areas of significant biodiversity. The Convention promotes and advances sustainable use concept and in line with the Principles of the Rio Agenda 21. In this Convention, Articles 1, 2 and 3 need particular attention as the project is being implemented.

Relevance to the project: The nature of aquaculture activities can be likened to what obtains in activities of the wetlands, therefore it is important that the Department operates in tandem and within the principles set out in this convention.

Compliance: The Project will work in line with the requirements of the convention

2.5.6 THE CONVENTION ON BIOLOGICAL DIVERSITY, 1992

A product of the Rio Agenda 21, this convention promotes the conservation and protection of biodiversity in general but provides for principles for biodiversity management strategies and also includes measures for addressing “invasive species”. Consistent with Agenda 21, equity and intellectual property rights principles are implied. In this regard Articles 1, 3, 6, 7, 9, 13 and 14 are important for this project.

Relevance to the Project: *The proposed conservation measures in this report are also aimed at attaining requirements of the CBD hence the relationship.*

Compliance: *The project will ensure that the provisions in the convention are adhered to so as to maintain biological diversity in the area.*

2.5.7 UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, 1992

The Convention rallies parties to take action to reverse anthropogenic factors responsible for the agreed accelerated climatic variations seen through changing temperatures due to an accelerated build-up of Green House Gases (GHGs) resulting from unsustainable industrialization models or technologies. Important to this project is Article 3 and 4.

Relevance to the project: *The relevance to this project is more on the vulnerability of the fishing industry to a changing climate that would include increase frequency of droughts as well as the rising temperatures that have a direct physiological functioning effect on fish including its productivity and availability of food in the case of wild catch.*

Compliance: *The Project will therefore work in compliance of with the demands of this protocol.*

2.5.8 STOCKHOLM CONVENTION ON PERSISTENT ORGANIC POLLUTANTS

Stockholm Convention on Persistent Organic Pollutants is an international environmental treaty, signed in 2001 and effective from May 2004, that aims to eliminate or restrict the production and use of persistent organic pollutants (POPs). POPs are defined as “chemical substances that persist in the environment, bio-accumulate through the food web, and pose a risk of causing adverse effects to human health and the environment”. Key elements provided for in Articles 1, 3, 5, 6, and 11 of the Convention include the requirement that developed countries provide new and additional financial resources and measures to eliminate production and use of intentionally produced POPs, eliminate unintentionally produced POPs where feasible, and manage and dispose of POPs wastes in an environmentally sound manner. Precaution is exercised throughout the Stockholm Convention, with specific references in the preamble, the objective, and the provision on identifying new POPs.

Relevance to the project: *Because of the activities that will be going on at the site that will involve handling of fish during processing and preservation.*

Compliance: *The Project shall ensure that imported refrigeration equipment meets the requirements of this protocol.*

2.5.9 FOOD AND AGRICULTURAL ORGANIZATION (FAO) CODE OF CONDUCT FOR RESPONSIBLE FISHERIES

The 1995 FAO Code of Conduct for Responsible Fisheries was adopted in Resolution 4/95 by the FAO Conference on 31 October 1995. The Code sets out principles and international standards of behaviour for responsible practices with a view to ensuring the effective conservation, management and development of living aquatic resources, with due respect for the ecosystem and biodiversity. The Code in Articles, 1, 2, 3, 4, 6, 7, and most important 9, 13 and 14 recognize the nutritional, economic, social, environmental and cultural importance of fisheries and the interests of all stakeholders of the fishing and aquaculture industries. The Code takes into account the biological characteristics of the resources and their environment and the interests of consumers and other users.

Relevance to the project: *The need that all aquaculture activities are done in conformity with this code.*

Compliance: *The Project shall ensure all the relevant sections of the Code are adhered to during all the phases of the project.*

2.6 INSTITUTIONAL FRAMEWORK

2.6.1 GENERAL

The main national institutions and agencies relevant to this Project are:

- a. Zambia Environmental Management Agency (ZEMA);
- b. Department of Fisheries in the Ministry of Livestock and Fisheries;
- c. Local Authority -Kafue Town Council;
- d. Zambia Aquaculture Enterprise Development Project (PIU); and
- e. Water Resources Management Agency (WARMA).

The function of each of these statutory bodies is discussed below, where relevant to this Project.

2.6.2 ZAMBIA ENVIRONMENTAL MANAGEMENT AGENCY

The Zambia Environmental Management Agency (ZEMA) is the umbrella environmental institution in Zambia and the main lead agency on matters pertaining to environmental impact assessments (EIA). It is empowered by the Environmental Management Act (N^o. 12 of 2011) (EMA) to identify projects, plans and policies for which environmental assessment is necessary. The general functions of ZEMA are to ensure the sustainable management of natural resources, the protection of the environment, and the control of pollution, as provided under Article 9(1) of EMA. In view of the scale and the significance of the project, the ZAEDP is required to submit an ESIA report for the proposed Aquatic Health Facility and Laboratory Project in Kafue to ZEMA, requiring approval from the agency to undertake the proposed Project.

2.6.3 KAFUE TOWN COUNCIL

Kafue Town Council is recognized under the Urban and Regional Planning Act, in consultation with the Provincial Planning Authority as a planning authority whose main responsibilities are the preparation, approval and revocation of development plans. ZAEDP recognizes that the project operates in the jurisdiction of the local authority and will observe the by-laws and regulations set up by the local authorities. Planning and building permission will need to be sought from the local authority.

2.6.4 WATER RESOURCES MANAGEMENT AUTHORITY

The Water Resources Management Authority (WARMA) was established by the Water Resources Management Act to ensure the management, development, conservation, protection and preservation of the water resource and its ecosystems as well as equitable and sustainable utilization of the water resource. Even though the use of the water in the Zambezi River for on-shore activities is non consumptive, there is a need to ensure that the vulnerable communities and the eco-system in general are not adequately affected by the damming operations. Permits will thus need to be sought from WARMA and the company will abide by any condition, limitation, restriction or prohibition that WARMA may impose for the sustainable utilization of the water in the rivers.

2.6.5 MINISTRY OF FISHERIES & LIVESTOCK-DEPARTMENT OF FISHERIES

The Executing Agency of the project is the Ministry of Fisheries and Livestock and all project monitoring will be conducted by the Department of Fisheries. All Environmental concerns will be handled through the implementation of the Environmental and Social Management Plan to be monitored by the Department of Fisheries at Ministry of Fisheries & Livestock with assistance from ZEMA.

2.6.6 ZAMBIA AQUACULTURE ENTERPRISE DEVELOPMENT PROJECT (PIU)

Zambia Aquaculture Enterprise Development Project will be the implementing agency. The day to day running of the Project activities will be the responsibility of the Project Core Team, which will include: a) A qualified Project Coordinator; b) Procurement Specialist, c) a Monitoring & Evaluation specialist, d) Accountant and e) Social/Gender Specialist. The Project Core Team (PCT) would be reporting to the Director of Fisheries and would be charged with the management and coordination of the Project's activities.

3 PROJECT DESCRIPTION

3.1 PROJECT LOCATION

The project site is in Kafue and the site is situated at approximately 900m northeast of the Nangongwe Primary School located along Kafue Road (T2). From Lusaka District, the site is accessed via Kafue Road turning left at Nangongwe Primary school, 1.5km after NCC Kafue Gospel church and about 1km before Zebra Stripes. The site is at 2.5km from the CBD. The GPS coordinates of the site are -15.786585 S and 28.178545 E lying at an average elevation of 1230m above mean sea level. Plot No: CLIXBY 86A. about 2.5ha.

The project area has the following developments:

- To the west of the site is the Kafue River, the Kafue River shares a boundary with the proposed project site, however all developments will be 50m from the edge of the Kafue River and across the River are private farms and residential areas at about 50m from the site;
- North- east of the site is a residential area characterized by newly build residential units, some old residential units, commercial establishments, Kafue Road and Nangongwe primary school;
- To the south is a general mixed-use development, characterized by residential, agricultural and commercial. The most notable residential and development establishments is Chimwemwe Township and Chita Lodge and resorts respectively; and
- Within the project site there are two existing buildings owned by the Fisheries Department and one illegal residential house. The said structures are situated close to the river banks.

Notable landmarks and developments surrounding the project site and their respective GPS Coordinates.

Table 3: Notable Landmarks and Developments Close to the Project Area

Notable Landmarks and Developments			
Landmark	GPS Coordinates		Distance from Site
Nangongwe Primary School	-15.72253	28.184077	900m
Total Filling Station	-15.773254	28.180092	1.3km
Kafue Bus Station	-15.77377	28.180041	1.8km
Rail Crossing Bridge on Kafue River	South		300 m

Table 4: The Site Boundary Positions in World Geodetic System 1984 (Wgs84), Coordinate System

Point ID	Latitude	Longitude
1	-15.785284°	28.179096°
2	-15.787867°	28.181727°
3	-15.789721°	28.179632°
4	-15.787610°	28.177446°



Figure 1: Existing structure on Site



Figure 2: Existing Ponds on site



Figure 3: Satellite Image of Kafue site



Figure 4: Kasaka Fisheries Training School Site

PROPOSED CONSTRUCTION OF LABORATORY AND QUARANTINE FACILITY IN KAFUE DISTRICT

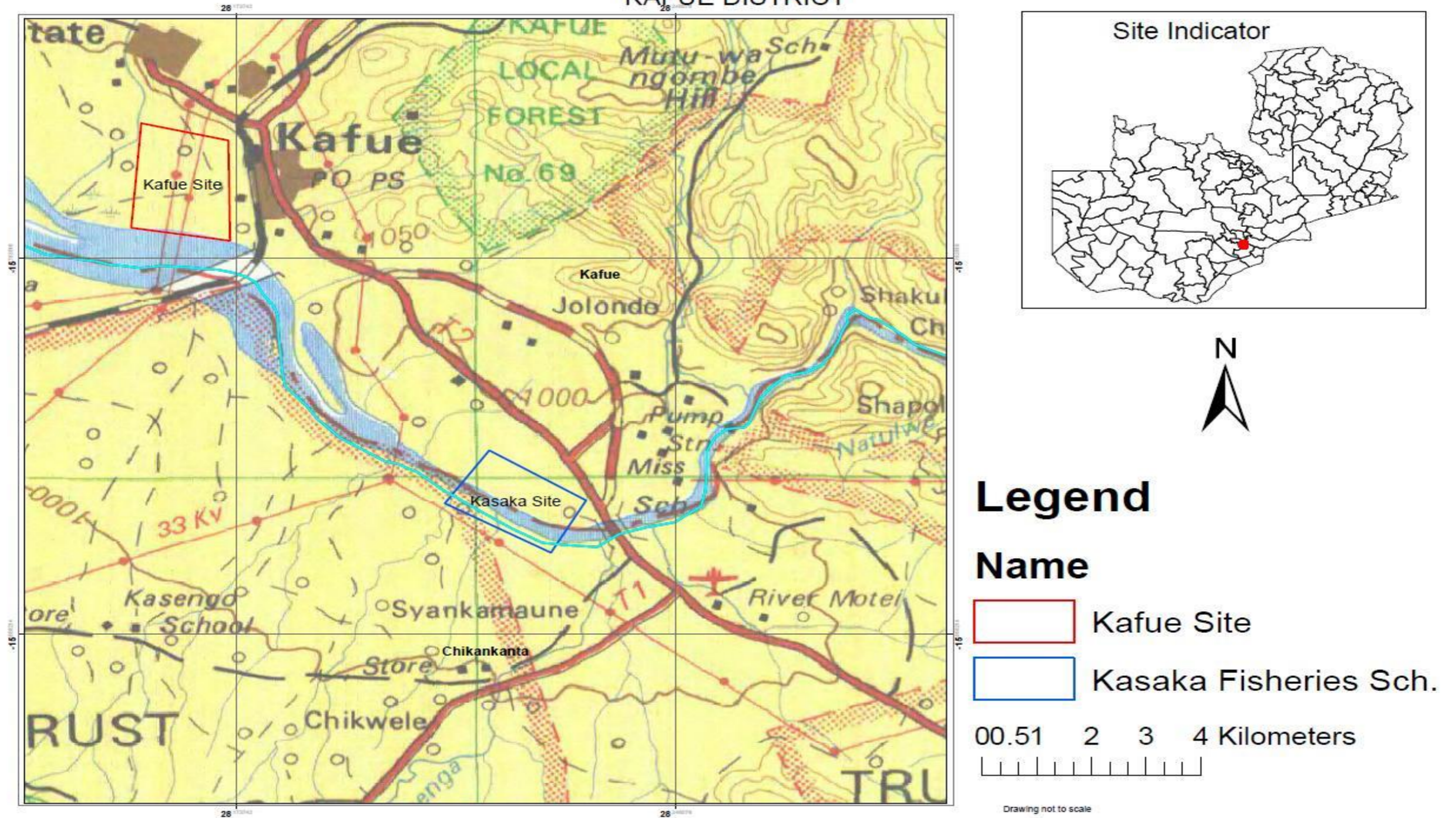


Figure 5: Kafue Topographic Map

3.2 NATURE OF THE PROJECT

ZAEDP facilities to be constructed in Kafue are as follows: (i) Demonstration Fish Ponds (Breeding, research, quarantine, production) 3000sq.m (ii) 1 Standard Food Safety Laboratory measuring 600 sq. m, (iii) 1 National Aquatic Animal Health Laboratories measuring 600 sq. m (iv) 1 indoor and outdoor quarantine laboratory measuring 300sq. m.

3.2.1 RAW MATERIALS

At the construction phase, the raw materials which will be required include the following:

- a. cement;
- b. reinforcing steel;
- c. structural steel
- d. fine and coarse aggregate for concrete and reinstatement of road works and paved areas;
- e. selected granular material in fill and bedding;
- f. timber for formwork;
- g. Ductile iron and HDPE water pipes;
- h. uPVC sewer pipes;
- i. precast units for chamber construction;
- j. valves;
- k. mechanical and electrical equipment and components;
- l. water; and fuel

3.2.2 PRODUCTS AND BY-PRODUCTS

3.2.2.1 CONSTRUCTION PHASE

No products will be generated at this stage. However, the construction activities will give rise to several waste products.

- a. **Vegetative waste:** The amount of vegetative waste resulting from site preparation will constitute of felled trees. This will be given to local interested groups who can use it for firewood.
- b. **Topsoil** will be used on the site for landscaping;
- c. **General building rubble** is expected to be generated which will include rejected blocks and concrete, gravel, timber off cuts, etc. Building rubble will be used as solid hard-core for slabs or backfill for existing pits that occur on the site.
- d. **Solid waste:** will include material such as scrap timber, various cut offs, refuse, packaging material (e.g. cement bags), workers' garbage, domestic waste etc. Collection and disposal will be contracted out to the approved Local Council contractor for the area and disposed of in accordance with the Local Authority and Zambia Environmental Management Agency Regulations.
- e. **Dust** will be generated from the site due to the nature of various construction activities during the construction phase. The work site and areas will be watered daily to suppress dust.
- f. **Sewerage:** workers' will be utilizing hired chemical toilets.
- g. **Storm water drainage** will be via road drains that will be constructed

3.2.2.2 OPERATIONAL PHASE

Effluents and by-products/waste generated during operation and their management (in summary):

- a. Solid (non-hazardous) waste will be collected on site in refuse plastics and will be regularly collected and disposed of by a designated and approved solid waste collector;
- b. Sewage will be channelled into the existing sewer network managed by LWSC. Storm water drainage will be via purposely-designed drains that will be constructed.

3.3 MAIN PROJECT ACTIVITIES

A phased approach will be taken on the site to ensure that all activities are implemented according to plans and with best practice. The project activities will include the following:

3.3.1 PREPARATION PHASE

All the planning related to the project, including budgeting, mobilising raw materials and equipment, will be carried out during this stage. Additionally, ZAEDP will obtain permits or approvals from relevant government institutions and agencies, which include ZEMA, DoF, WARMA and Kafue Town Council.

3.3.2 CONSTRUCTION PHASE

This phase will include erection of physical buildings/infrastructure and installations. All constructions activities will be performed during phase of the project. The table below outlines the scope of work to be executed during this phase.

3.3.2.1 DETAILED SCOPE OF WORKS DURING CONSTRUCTION PHASE

Table 5: Infrastructure for the National Aquatic Animal Health and Food Safety Laboratory

Province	Research station	Offices	Kitchen	Lecture room	Resource room	Boardroom	Modern weather station	Borehole	Staff houses	Feeder road (K m)	Wall fence
Lusaka	National Aquatic Animal Health and Food Safety Laboratories (Kafue)	10	1	1	1	1	1	2	22	5	1

Table 6: Basic definition for infrastructure for the Quarantine Facility

Province	District	Indoor quarantine facility	Outdoor quarantine facility
Lusaka	Kafue	1	1

3.3.2.2 PUBLIC INFRASTRUCTURE

- a. Rehabilitation of access feeder roads from the main road to the service centre,
- b. Electrification of service centres.

3.3.3 OPERATION PHASE

This phase will involve full operationalization of the Food Safety Laboratory, National Aquatic Animal Health laboratory and Outdoor Quarantine facility.

4 PROJECT ALTERNATIVES

4.1 IDENTIFICATION AND ANALYSIS OF PROJECT ALTERNATIVES

4.1.1 NO PROJECT OPTIONS

The “Do-Nothing Option” or Zero Option Alternative implies the project does not proceed thus upholding the status quo. The model helps the proponents to measure impacts from the project baseline information and helps in the assessment of impacts in regard to the project’s activities. The status of the environmental resources neither improves nor worsens since the state of the resources is not affected. However, the implementation of this Zambia Aquaculture Enterprise Development Project (ZAEDP) is aimed at stimulating a viable aquaculture sub-sector in Zambia to promote economic diversification, food security and sustainable employment generation, all of which are central priorities of the Government of Zambia. The Project is expected to nurture a domestic aquaculture subsector which will serve as a viable and inclusive business opportunity, through enhanced production and productivity to improve the livelihoods of men and women beneficiaries, along the aquaculture value chain. The targeted fish farmers are expected to improve their business and managerial skills and the quality of their productive systems to increase output, efficiently, while keeping fish prices affordable and meet growing demand from the lucrative domestic market.

The ‘Do-Nothing Alternative’ means that:

- a. the local populations continue to suffer from poverty, food scarcity and consequently food insecurity; and
- b. Projected increase in poverty levels.

On the basis of these, the Do-Nothing Option was dropped from further consideration as it is not within GRZ aspirations of promoting the aquaculture sector in Zambia.

4.1.2 SITE ALTERNATIVES

The choice of the sites was based on scientific evidence of appropriateness such as water availability, location, land use, plot size, good drainage system and above all, the proposed project area is owned by the Department of Fisheries. The Kasaka Fisheries Training Institute was proposed to be the alternative site location.

4.1.3 WATER SUPPLY ALTERNATIVES

Three alternatives were considered for water supply as follows:

- a. Lusaka Water Supply and Sanitation Company - This is a utility company that supplies water to most parts of Lusaka Province. The project area is already connected to the Lusaka Water Supply and Sanitation Company water distribution network in Kafue District.
- b. Water abstraction from the Kafue River – The Kafue River is located on the western end of the project site. Abstracting water from the River for the proposed development is an option. The River is currently being used as a source of water for domestic use and by some subsistence farmers living along the banks of the River.
- c. Ground water abstraction – From the hydrogeology baseline study the project area has high ground water potential.

- d. During project implementation, option a of utilising the already connected water supply to Lusaka Water Supply and Sanitation Company will be utilised for domestic usage considering the water is treated for consumption. During the operation phase, option a will be augmented by option c of exploiting groundwater. Option c is considered as a supplementary to option a in that connectivity and issues related to operations and maintenance will be easy to manage with an on-site facility as opposed to a distant facility from the River.

4.1.4 SEWAGE MANAGEMENT ALTERNATIVES

Two alternatives were considered for sewage management:

- a. Septic tank and soak away- septic tanks are watertight chambers sited below ground level which receive excreta and flush water from flush toilets and other wastewater. The solids settle out and break down in the tank. The liquid remains in the tank for a short time before overflowing into a sealed soak away or drain field where it infiltrates into the ground. A permeable soil is essential for the soak away to function properly. This system is easy to manage and maintain and can be applied to small and large capacity of people.
- b. Lusaka Water Supply and Sanitation Company (LWSC) - This is a utility company that ensures that sewage is cleaned so that it is not harmful or dangerous to the environment. There project area is serviced by Lusaka Water Supply and Sanitation Company LWSC.

Option B will be utilised in the management of sewer on site conditions. In the event of option a, the septic tanks will be periodically dislodged or emptied using the Lusaka Water Supply and Sanitation Company sludge management facilities.

4.1.5 TECHNOLOGY ALTERNATIVES

The technology to be used in project implementation will make use of human and machine labour. No other technology alternatives were considered.

4.1.6 MATERIAL ALTERNATIVES

- a. Glass curtain windows, re-used wood and sandstone tile - This is the modern material that is used in building construction. This combination of materials is expensive but looks very beautiful.
- b. Earth, concrete, and brick work - This material has been used in building construction. It is readily available on the market and therefore the building does not entail excessive costs. The material can be made to look modern or old depending on the design of the building and the construction workers used.

4.1.7 POWER SUPPLY ALTERNATIVES

The alternatives for power supply are either to connect to hydropower power supply or Backup Silent Generator set with 42KVA. Both options will be used.

5 BASELINE ENVIRONMENTAL AND SOCIAL-ECONOMIC SETTINGS

5.1 PHYSICAL ENVIRONMENTAL CONDITIONS

5.1.1 CLIMATE

Climatic conditions influencing the project area cycle through a warm, wet season from December to April (average daily temperature of 23°C and a mean rainfall over the period of (800-1200mm). Rainfall during this period is associated with the movement through the area of the Intertropical Convergence, but is increasingly localised resulting from convective cells within the convergence zone. Winds are generally between westerly and north-easterly, depending on the location of the driving mid-tropical high- and low-pressure systems. Wind speeds are generally low (<2 m/s), but convectional storm systems can generate local wind speeds exceeding 4m/s. During this period average humidity is high and evaporation rates low. The warm, wet season is followed by a dry, cool period from May-August (average daily temperature 19°C and night-time temperatures occasionally lower than 8°C).

5.1.2 TOPOGRAPHY

The terrain of the project area comprises gently low landscape often in the form of broad, wet, grass-filled geomorphic units known as Dambos and the high ground of the resistant elements of limestone and granite rocks. The Zambezi rift escarpment is dominated by a series of north-east-south-west aligned fault scarps forming topographic steps down to Lake Kariba.

5.1.3 DRAINAGE

The Kafue River is the principal constituent of the drainage system in the project site. The Kafue River has incised into the escarpment with a more uniform profile but is controlled by resistant quartzite formations.

5.1.4 SOIL

Underlying geology and soils are important contributors to the nature of vegetation growth and associated ecological processes. Soils in the project area have mostly been developed in-situ from deep weathered metamorphosed, mainly quartzitic sediments and are aligned north-east/south-west with the main geological structures. The principle source materials are: alluvium in the vicinity of the Kafue River; colluvial valley slope materials (mostly quartzites); Muva quartzites over most of the project areas; and bedded between the quartzite exposures, Muva shales and schists.

The resulting soils are classified according to the World Reference Base for Soil Resources (FAO, 2015) and are in four major groups (each with some variation):

- a. young alluvial sandy and clay soils (depending on moisture conditions either Vertisols, or Gleysols);
- b. skeletal, stony soils on escarpment and steep valley slope areas (Regosols and Litosols);
- c. yellow-red to red-brown, sandy-clay loam soils over the Muva shales and schists (Acrisols); and
- d. predominantly acidic, leached (low base saturation), partially ferrallitic, yellow to brown sandy loam soils, often becoming sandy-clay loams at depth, over Muva Quartzites (Acrisols).

A generalised soil distribution is shown in Figure 5.5 that is adapted from the Exploratory Soil Map of Zambia. (MoA, 1991). Generally, the sandier soils phases have high porosity, resulting in limited

surface runoff and relatively low erosivity, unless compacted. Sites with pronounced breaks of slope and associated active wetting/drying regimes are often sites with ferricrete formations. Muva quartzite lithologies occur to the north and south of the Muva schists and shales, with a corresponding increase in the sand fraction in soils formed over them, resulting in moderately deep, yellow-brown to dark brown, low base saturation Acrisols. Soils within the Kafue valley around quartzite rock exposures and on the steeper, colluvial valley slopes are generally shallower, yellow-brown to brown skeletal, orthic-dystic or lithic (depending on stoniness) Leptosols. Soils in permanently wet, river-side locations are typically highly reduced and may be gleyed at depth over 30 cm, with grey to blue-grey coloration, forming orthic-dystic Gleysols. Back swamp locations that are seasonally flooded with significant alluvial deposition create zone of deep cracking clays, usually over a sandier alluvial horizon and are either Vertisols, or Planosols where there is an abrupt change of horizon from clay to sand. The soils around the project site in Kafue are characterized by strongly leached reddish to brownish clayey to loamy soils derived from acid rocks (Miombo). The main soil components are orthic/xanthic ferralsol soils with an average pH of 6.9.

5.1.5 GEOLOGY

The proposed project site is located over Basement Complex lithologies. Erosion of the Kafue valley has exposed a geological sequence through rhyolites and other volcanics along the Kafue River margin, then older quartzites exposed in the edge of the rift escarpment as far as Chilanga. Granites have intruded through the Muva sequences to the north of the project area and to the west.

5.1.6 HYDROLOGY

5.1.6.1 CATCHMENT CHARACTERISTICS

The hydrological characteristics of the Kafue basin are central to the viability of the boating developments in the area. The Miombo woodland cover and extensive Dambos contribute to flow stability and reduced flood concentration of the Kafue River.

5.1.6.2 SURFACE FLOW CHARACTERISTICS

Flow in the Kafue river reflects the distinctly seasonal nature of rainfall in the area with a hydrograph peak in February, March and April and lowest flows in September, October and November. The mean flow from government hydrological records measured at Kafue Bridge between 1975 and 1997 was 106.6 m³/s, with mean maxima and minima of 200.9 m³/s and 19.6 m³/s, respectively and absolute maxima and minima of 457.5 m³/s and 2.9m³/s. This translates to volumes of 1.44 x 10¹⁰m³ and 91.45 x10⁶ per annum, respectively.

5.1.7 HYDROGEOLOGY

Groundwater resources in the project areas are chiefly in the fractured quartzite formations and weathered granites. Boreholes developed in weathered granite are often susceptible to iron contamination. The argillaceous (clay-rich) shales of the Muvan geology generally do not support good groundwater resources, but the quartzites should host good local aquifers. There are few available groundwater quality data, but away from high-density settlements (where some faecal contamination is possible), groundwater quantity is expected to be adequate to meet demands and quality for construction camps and other uses is likely to be good, provided there is no iron contamination.

5.1.7.1 WATER QUALITY (SURFACE AND GROUNDWATER)

Surface water quality in the project area with specific reference to the Kafue River exhibits levels of neutrality with the pH being in the range of 7.62 based on the sampled water. However, it is generally mildly acidic and generally, potable if treated for coliforms. The coliforms at the time of sampling were in the order of 96 and 22 (#/ml) for Total and Faecal Coliforms, respectively. Reference sampling data results are indicated in Appendix 4.

Some pollution of water sources occurs through effluent drainage and use of river for washing, cleaning and gardening. No easily accessible borehole supplies were identified for sampling during the wet season baseline work and no data are available from previous studies. Adequate river water is available to support construction teams and construction works during the project life.

Based on the sampled water, it is recommended that a robust water quality monitoring system should be setup as a project component for continuous monitoring of the water quality.

5.1.8 AIR QUALITY

Air quality in southern Zambia has steady easterly winds during the dry months (May- October), and a generally weaker, north-westerly air stream during the wet months. The air sampling was conducted, at both sites in November 2020.

Table 7: Air Quality Measurements in Gwembe

Location	TSP ¹ (µg/m ³)	PM ₁₀ ² µg/m ³)
Kafue Site		
Point 1	31.8	15.3
Point 2	31.4	13.0
Point 3	32.9	14.1

Source: Kaizen Field Study

Table 8: Zambian Guideline Limits for Ambient Air Pollutants

Parameter	Reference time		Guideline limit
Sulphur dioxide (SO ₂)	10 minutes		500 µg/m ³
	1 hour		350 µg/m ³
Sulphur dioxide (SO ₂) in combination with Total Suspended Particles (TSP) and PM ₁₀	SO ₂	24 hours	125 µg/m ³
		6 months	50 µg/m ³
	TSP	24 hours	120 µg/m ³
		6 months	50 µg/m ³
PM ₁₀	24 hours	70 µg/m ³	
Reparable particulate matter PM ₁₀	PM ₁₀	24 hours	70 µg/m ³
Oxide of nitrogen (NO _x) as nitrogen dioxide (NO ₂)	1 hour		400 µg/m ³
	24 hours		150 µg/m ³
Carbon Monoxide (CO)	15 minutes		100 mg/m ³
	30 minutes		60 mg/m ³
	1 hour		30 mg/m ³
	8 hours		10 mg/m ³
Ambient Lead (Pb)	3 months		1.5µg/m ³
	12 months		1.0µg/m ³
Dust fall	30 days		7.5 tonnes/km ²

Source: Regulation 5, 6 and7 (1) of The Environmental Management (Licensing) Regulations, No. 112 of 2013

¹ TSP = Total Suspended Particles, particles with diameter less than 45 micrometres(µm)

² PM₁₀ = Respirable Suspended Particulate Matter, particles with less than 10 micrometres(µm)

From the analysis of air quality measurements in line with the statutory Ambient Air Guidelines, it can be concluded that the concentration levels of were within the prescribed guidelines.

5.1.9 NOISE QUALITY

Noise levels are well below those of even rural towns, except during the movement of the train. During training movements, the discernible noise levels from the train may extend over two hundred metres. There is no discernible vibration in the project areas away from the rail line, unless during periodic seismic events.

The baseline noise level measurements for the project area during the periodic train movement is in the order of up to 72 dBA in that short interval and normalises to an average of 46.4 dBA. This is well below the recommended sounds of 85 dBA the level above which could be harmful.

Table 9: Noise Measurements

Sampling Point	Coordinate		Reading 1	Reading 2	Average
<i>Site Location 1</i>	-15.785284	28.179096°	<i>40.1</i>	<i>43.4</i>	<i>41.8</i>
<i>Site Location 1</i>	-15.789721°	28.179632°	<i>44.8</i>	<i>47.9</i>	<i>46.4</i>
<i>Alternative Site</i>	<i>13° 40' 0.2."</i>	<i>32° 41' 53.8"</i>	<i>49.5</i>	<i>53.9</i>	<i>51.7</i>
<i>Alternative Site</i>	<i>13° 51' 24.2"</i>	<i>32° 47' 31.2"</i>	<i>45.8</i>	<i>50.9</i>	<i>48.35</i>

5.2 BIOLOGICAL ENVIRONMENT

5.2.1 FLORA

In the project area, this ecological grouping is characterised by a narrow band of diverse escarpment woodland north and west of Kafue; extensive tracts of mixed Miombo woodland dissected by headwater dambos grasslands; with small embedded areas of wet forest riverine and back swamp vegetation types. In biome terms these units are known in Zambia as Escarpment, Plateau Woodland and Upper Valley vegetation groups, respectively. The baseline studies have focused on: describing levels of biodiversity in the various flora and fauna groups. The following description is of the terrestrial ecology around the project:

5.2.1.1 DESCRIPTIONS OF VEGETATION GROUPS

The predominant vegetation in the project area is a mosaic of Miombo Woodland, and termitaria. This vegetation type is common throughout Zambia and in the Kafue district. Dambos and floodplains occur scattered throughout the site and often contain some riparian forest, which occurs along the river banks.

There is little vegetation within the study site that is not impacted upon by people, primarily by agriculture.

The following sections describe the vegetation groups of the project area follow this distinction and depict the characteristics of the other key land cover units as found throughout the sample areas.

5.2.1.1.1 AGRICULTURAL LAND

The area in the immediate vicinity of the project site does not show much evidence of agricultural activity although there is evidence of settlement and small-scale agriculture within the project site. The current cultivation of crops is confined to the settled areas along the roads leading to the project site. Vegetation in areas disturbed by agricultural activities includes elements of miombo regrowth and ruderal weed species (*Bidens pilosa* and others). Some the planted fruit trees include *Mangifera indica* and *Psidium guajava*.

5.2.1.1.2 MIOMBO WOODLAND AND ITS SUB-COMPONENTS

The proposed project location is within an already developed or built up environment with residence and ponds in the vicinity, devoid of any natural flora. However, within the project foot print, miombo woodland makes up for the greatest portion of the affected area. The most common and widespread canopy dominant is *Julbernardia paniculata* (mutondo), while common associates include other caesalpinoids, *Brachystegia floribunda* (chifwanga), *B. longifolia* (chombwe), and *Isoberlinia angolensis* (mutobo) and *Pterocarpus angolensis* (mulombwa). More local are *Brachystegia boehmii* (ngansa), *B. spiciformis* (muputu) and *Erythrophleum africanum* (kayimbi).

A variety of small trees and shrubs form an understory, including *Baphia bequaertii* (mubumbu), *Dalbergia nitidula* (kalongwe), *Diplorhynchus condylocarpon* (mwenge) and the fruit trees, *Uapaca kirkiana* (musuku) occurring locally particularly over gravel, *Anisophyllea boehmii* (mufungo) and *Strychnos innocua*. (kasongole)

Subshrubs are common, notably papilionoids *Clitoria kaessneri*, *Dolichos kilimandscharicus* (chibombolwa), *Sphenostylis erecta*. Suffrutices, *Annona stenophylla* and *Lannea edulis* (luimbwa) are occasional.

Termitaria

Conical termitaria from 1m – 5m in height, impart a very characteristic appearance to the surrounding landscape of the project site. The conical termitaria support a growth of particular tree species and also of dense evergreen shrubs and scramblers. Some of the common trees occurring on termitaria are: *Cassia abbreviate* (Munsokansoka), *Combretum* species (mufuka), *Commiphora mollis* (mubwabwa) and *Diospyros mesipiliformis* (muchenja). Termitaria vegetation occurs as islands within the miombo woodland. Even though this vegetation type does not occur at the proposed site, its proximity to the site warrants it to be recognised

5.2.1.1.3 DAMBO GRASSLANDS

These are characteristic of portions of the landscape adjacent to the project site that inundate regularly in the rainy season. These wetlands contain many grass species as well as herbaceous species that make up the vegetation type. Waterlilies, *Nymphaea nouchali* (matuwa) are characteristic of the pools. Poorly drained wet areas are dominated by the coarse sedge, *Cyperus digitatus* (fibengansobe). The tall orchid *Eulophia alta* (nkongola) occurs in this zone. Better drained soils are frequently dominated by grasses such as *Setaria sphacelata* (misekese).

5.2.1.1.4 BACKSWAMP FLOODPLAIN GRASSLANDS

Back swamp floodplain grasslands occur along the fringes of the Kafue river within the proxies of the project site. They receive water as overbank spill into surrounding land. The back-swamp grassland fringe is subject to inundation for shorter period than dambos. *Syzygium guineense* subsp. *barotsense* (insafwa) is the character tree of the riverbank while backswamp vegetation includes reed (*Phragmites mauritanus*, matete), the swamp grass *Vossia cuspidata* (munungwe) and waterlilies (*Nymphaea* spp).

5.2.1.1.5 RIVERINE FOREST

These are strips of fringing forests occur along the Kafue river with the project site and adjacent areas. The riverine vegetation, as the interface of the terrestrial and aquatic ecosystems anchors the Kafue river's edge. Much of gallery forest of the Kafue River consists of a single line of *Syzygium guineense* subsp. *barotsense*, with *Rhus quartiniana* and *Salix mucronata* on the outer fringe. The inner fringe contains beds of *Phragmites* reeds.

This vegetation is subject to deep flooding after heavy showers in the catchment. This streamside vegetation plays an important role in reducing river bank erosion and subsequent silting.

5.2.1.1.6 FLOOD-PLAIN GRASSLAND

The floodplain grasslands occupy the major part of the project site and consist of grasses predominantly of the species *Enchinochloa scabra*, *Vossia cuspidata* and *Oryza longistaminata*. These grasslands are normally deeply flooded at the height of the floods especially after opening Ithezhi tezhi dam. The common plant species associated with flood plains particularly on banks are *Phragmites mauritanus*, *Echinochloa stagnina*, *Oryza barthi*, *Panicum repens* and *Cyperus esculentus*. Common abundant herb species include *Cleome monophylla*, *Euphorbia prostrata* and *Sesbania sesban*.

5.2.2 FAUNA

A summary of faunal groups in the project can be summarized as follows:

5.2.2.1 MAMMALS

5.2.2.1.1 LARGE MAMMALS

The project site comprises a built-up area and no evidence of large mammals was found

5.2.2.1.2 SMALL MAMMALS

Miombo Woodland

Small mammal populations appeared extremely low over the project area. The Bush Squirrel (*Paxerus capapi*) was seen. Occasional spoor and droppings/scat evidence were also noted for Black-tailed Scrub Hare (*Lepus saxatilis*), Lesser Cane Rat (*Thrynomys gregorianus*), and possibly either the Spotted-necked Otter (*Lutra maculicollis*); or the Clawless Otter (*Aonyx capensis*).

5.2.2.2 AMPHIBIANS

Six species of amphibian were identified around the project site during the wet season baseline studies. No species of conservation concern were noted. All of the species identified are typical of the broader habitats and are known to occur in the greater area.

5.2.2.2.1 RIPARIAN AND SWAMP FORESTS

Puddle Frogs (*Phrynobatrachus* spp.) and Stream Frogs (*Ptychadena* spp.) were the most numerous frogs within the general riparian environment, although within the existing fish ponds the River Frog *Amietia moyerorum* was reasonably common.

5.2.2.3 REPTILES

Five species of reptile were recorded from the project area, although the fish traders confirmed the presence of a significant list of snakes in the area.

5.2.2.3.1 RIPARIAN AND SWAMP FOREST

Within the project area, the skinks *Trachylepis varia* and *Trachylepis striata wahlbergi* could be reliably found on the exposed surfaces along the river's edge, albeit in small numbers. None of the recorded species are considered threatened at a species level/ though it is important to recognise this habitat, the project will not have any impact on it.

Table 10: Species Currently Recorded in the Project Area

Large Mammals	Species Name	IUCN Red List Status	Estimated Population	Current
Nil				
Smaller Mammals				
Scrub Hare	<i>Lepus saxatilis</i>	LC	Common	
Reptiles				
Nile Crocodile	<i>Crocodylus niloticus</i>	LR/LC	Present	
Nile Monitor	<i>Varanus niloticus</i>	LC	Fairly common	
Savannah Monitor	<i>Varanus exanthematicus</i>	LC	Fairly common	
Black-necked Spitting Cobra	<i>Naja nigricollis</i>	NA	Fairly common	
Gaboon Viper	<i>Bitis gabonica</i>	NA	Present	
Puff Adder	<i>Bitis arietans</i>	NA	Fairly common	
Chameleons	Various mainly <i>Chamaeleo spp</i>	NA	Fairly common	

Source: ESIA Survey

Table 11: List of Mammal Species Observed in the Project Area,

Family/Sub-Family/Scientific Name ^{3,4}	Status / Likelihood of Occurrence	IUCN Red List Status	English Name	Bemba Name
Macroscelididae				
<i>Petrodromus tetradactylus</i>	Reasonably common	LC	Four-toed Elephant Shrew	Tondo
Hippopotamidae				
<i>Hippopotamus amphibius</i>	Occasional vagrant	VU	Hippopotamus	Mfubu
<i>Alcelaphus buselaphus lichtensteini</i>	Rare or no longer	LC	Lichtenstein's Hartebeest	Inkonshi
Aepycerotinae				
<i>Aepyceros melampus</i>	Scarce - Lusenga	LC	Impala	Impala
Antilopinae				
<i>Oreotragus</i>	Rare or no longer	LC	Klipspringer	Chipomo
<i>Raphicerus sharpei</i>	Possibly present	LC	Sharpe's Grysbok	Katili
Largomorpha				
Leporidae				
<i>Lepus saxatilis</i>	Present	LC	Black-tailed Scrub	Kalulu
Rodentia				
Bathyergidae				
<i>Fukomys amatus</i>	Present	LC	Zambian Mole Rat	Mfuko
Thyryonomidae				
<i>Thryonomys gregorianus</i>	Present	LC	Lesser Cane Rat	Nsengele/ Nsenshi
Cricetidae				
Dendromurinae				
<i>Steatomys pratensis</i>	Reasonably common	LC	Fat Mouse	Ntika
<i>Dendromus mysticalis</i>	Present	LC	Chestnut Climbing Mouse	
Cricetomyinae				
<i>Cricetomys gambianus</i>	Reasonably common	LC	Northern Giant Pouched Rat	Londwa/ Nsengele
Muridae				
Murinae				
<i>Praomys delectorum</i>	Present	LC	Delectable Soft-furred Mouse	
<i>Mus musculus</i>	Common	LC	House Mouse	Akafumbe

³ Ansell, W.F.H., 1978: *The Mammals of Zambia*, National Parks and Wildlife Service, Chilanga, Zambia⁴ Smithers, R.H.N., 1983: *The Mammals of the Southern African Subregion*, University of Pretoria, South Africa

<i>Rattus</i>	Common	LC	Rat	Koswe
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5.2.3 BIRDS

During, ESIA the following birds were documented on the project site through a combination of survey approaches i.e. timed species counts, visual encounter surveys (VES), opportunistic encounters. They include: Lizard Buzzard (*Kaupifalco monogrammicus*), Red-eyed Dove (*Streptopelia semitorquata*) Common Bulbul (*Pycnonotus barbatus*), Miombo Grey Tit (*Parus griseiventris*) Eastern Black-headed Oriole (*Oriolus larvatus*), Black-crowned Tchagra, (*Tchagra senegala*), Fork-tailed Drongo, (*Dicrurus adsimilis*), Golden-breasted Bunting (*Emberiza flaviventris*) and African Darter (*Anhinga rufa*)

5.3 SOCIO-ECONOMIC CONDITIONS

5.3.1 DISTRICT ADMINISTRATION

The Project is located in Kafue District of the Lusaka Province of Zambia. Kafue District has a population of 219,000, with an even gender divide. The majority of the population in Kafue are rural (94%), however, Lusaka Province is predominantly urban, with only 15% considered rural. Population density in Lusaka Province is high, at over 100 persons per km², however, the rural nature of Kafue means a much lower population density is recorded around the Project area, at 38 persons per km². Population growth in Lusaka Province is considerably higher than the national average of 2.8%, at 4.6%. Kafue District has also experienced above average population growth between 2000 and 2010, at 4.1%, impacted by migration from other Provinces of those in search of economic opportunities. Most of the households in the project area are located within less than 1km from the Kafue River where water for domestic use such as laundry and in some cases, drinking is drawn. It is also along the river that vegetable gardens largely owned by men are located. The site along the river is highly punctuated with a number of canoes which is an indicator of many people fishing or crossing the river.

5.3.2 DEMOGRAPHY

Kafue is classified as a rural town whose population predominantly resides in the rural areas. According to 2010 Census (CSO, 2011), 88% of the people in the district were in rural areas while 12% lived in the urban area. The total population for Kafue has been steadily increasing from 117,354 people in 1990 to 150,217 people in 2000 and to 219,000 people in 2010 (Census 1990, 2000, 2010). The increase is mainly attributed to natural increase and migration from other districts and provinces particularly for the farming communities. Of the population in 2010, males were 108,939 (49.74%) while females were 110,061 (50.26%).

5.3.3 ECONOMY

Although the main predominant economic activity in the area is farming, there are other sectors that have been established to support the population in the fringes of the project site such as schools, clinics, shops, bars and lodges. Those in formal employment like teachers support their livelihoods from their monthly salaries, the other local people engage in various activities which include subsistence farming, trading and doing seasonal work at surrounding farms. Fishing is done on a small scale by many households in the project area. Poverty in Zambia continues to remain more of a rural phenomenon than an urban one. The 2010 Census of Population and Housing showed that the majority of Zambia's population, 65%, lived in rural areas. Urban poverty in 2010 was estimated at 27.5%, compared to 77.9% in rural areas. As discussed earlier, the Kafue populations are mostly rural and agriculture dependent. With this, the opportunities for economic

diversification, low across Zambia which is further challenged by a mismatch between skills supply and industry demands, are particularly low in the Kafue. Inequalities of water access and adequate sanitation are strong indicators of rural poverty; in 2012 the proportion of rural population with access to safe water supply was 60% while the proportion of rural population with access to adequate sanitation was 40%.

5.3.4 EDUCATION

Kafue district has 3 tertiary colleges, Kafue Institute of Health Sciences Education, Northern Kafue College of Education and Kafue College of Technology. There are 6 secondary schools and 58 primary schools. The district also has 10 private schools. In terms of employment provision in the district, the education sector is one of the main sources of employment particularly for teachers and other auxiliary workers

5.3.5 HEALTH

In terms of health services provision, the main provider in the district is government which runs 28 health centres, 12 health posts and a General hospital. There are 3 private clinics in the district. Rural communities are mostly served by health posts and centres which are manned by clinical officers and nurses. In most cases, the rural facilities are under staffed and poorly stocked with medicines forcing the majority of the rural communities to trek to Kafue urban for better health services.

5.3.6 HIV/AIDS

Kafue District has a higher HIV prevalence rate than the national average. However, the district prevalence rate is slightly lower than the provincial average. According to Zambia Demographic and Health Survey of 2007, the prevalence rate for Central province is at 17.5%. Kafue's adult HIV prevalence rate was at 19.3% in 2017 according to the District Health Information Office. The main drivers of HIV infection in Kafue district include the following: Prevalent practice of multiple sexual partners; low and inconsistent use of condoms; sex workers and prostitution; mobility and labour migration and low male circumcision.; and Mother to child transmission.

5.3.7 ENERGY

Kafue District is connected to the National Grid. The project site area has existing structures connected to the national grid, though Backup Silent Generator Set will be used as alternative to hydro power.

5.3.8 COMMUNICATION

Zamtel lines services Kafue district with fixed telephone lines. Communication by mobile phone is readily available through Airtel, MTN and Zamtel networks. Internet is also available in the area.

5.3.9 WATER AND SANITATION

Lusaka Water Supply and Sanitation Company is the main supplier of water to Kafue District. Kafue district has 9,400 households that are connected to tap water. Most of these households are located in urban areas. The rural farming communities especially the commercial farmers and some medium scale farmers also have tap water. The majority of the population in the district do not have access to safe water. People in the project area obtain water mainly from boreholes, shallow wells, the Kafue River Most urban households with access to tap water have flush toilets and this applies to commercial farmers as well. Households of peasant farmers and those in unplanned urban settlements either have pit latrines or use the bush.

5.3.10 LAND TENURE

There are several Acts governing the administration of land, viz; Cap 292, 289, 288 for the allocation and alienation of land, Land Acquisition Act which provides for the compulsory acquisition of land and the Local Government Act (No. 22 of 1991) which provides for control of land by Local Authorities. Under the Land Act, land has been demarcated into categories, namely: state, local authority and traditional land. The traditional authorities (Chiefs) have rights over the traditional land, with a mandate to recommend to Government lease to those who want to acquire land.

The project site is an existing fisheries site, owned by the Ministry of Fisheries and Livestock.

5.3.11 LAND USE

The basic land use activities in Kafue are farming by peasant, medium scale and commercial farmers. The areas within and surrounding the project site are occupied predominantly by small-scale farmers with a few commercial farmers. Dambos dominate land use in the project area and are a crucial component of current livelihood strategies for the community. Most of the dambos areas are used by the small-scale farmers as areas for growing a variety of vegetables and fresh maize. Most villages are located on higher ground that does not get submerged during flood periods. The low-lying areas are also pasturelands for some farmers who keep livestock for domestic and commercial purposes. Therefore, land use has dual purposes, crop farming and animal husbandry.

5.3.12 TRADITION, CULTURE AND ARCHAEOLOGICAL

Archaeological and Paleontological materials (artefacts) are very important as they give an insight into Zambia's ancient past. The proposed developments on the project site, will done on the existing fisheries site, in close proximity to the existing structures. It was seen that the project will have no impact.

5.3.13 BUILT ENVIRONMENT

The built environmental observed in the immediate project area during the site visits include residential houses.

6 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

These are discussed under two broad themes namely, positive and negative impacts as below:

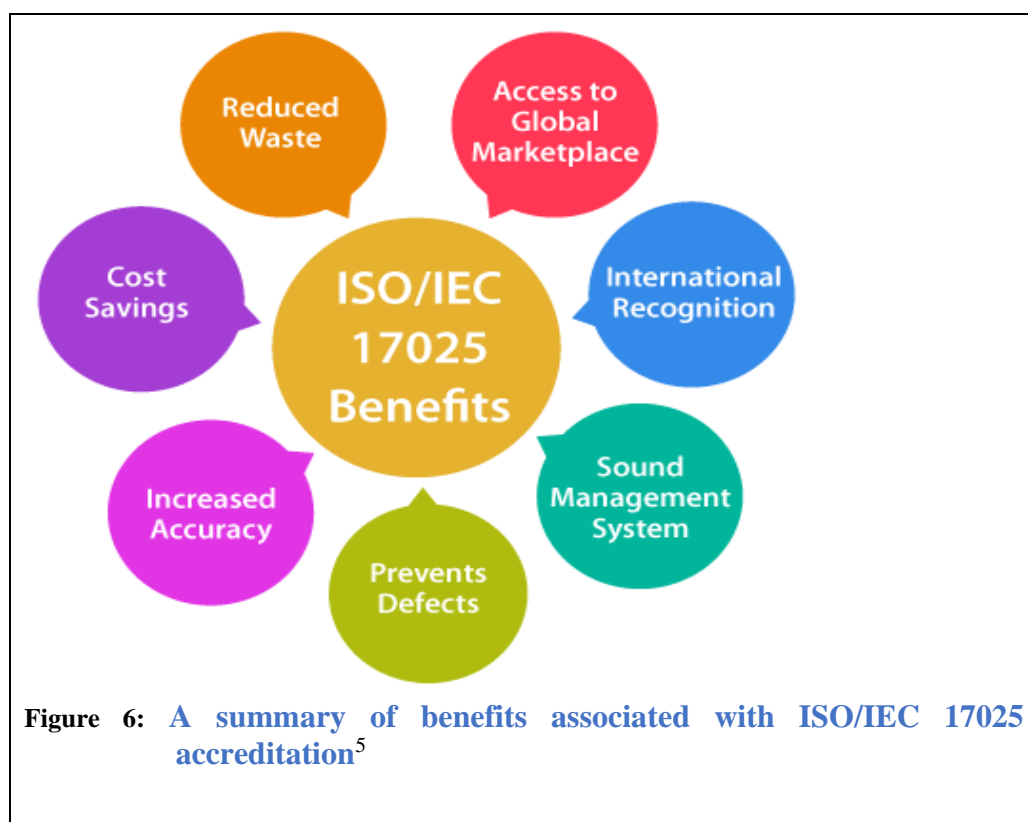
6.1 POSITIVE IMPACTS

6.1.1 CONTRIBUTE TO IMPROVED DIAGNOSIS OF FISH FOR DISEASES

By and large, the project will contribute to improved delivery of fishery which is free and fit for human consumption as well as meet international market requirements especially in European Union markets. Through this, the fishery sector in the country will be competitive penetrating wider markets and earning competitive prices.

6.1.2 ENHANCED SAFETY OF FISH AND ITS PRODUCTS

The planned ISO laboratory facility is poised to play a key role in food safety through array of its microbiological and chemical testing which will be important activities in ensuring food quality and safety through established rules, guidelines or characteristic activities aimed at achieving optimum degree of safety on the food and fish for human consumption needs. In addition, the operations of planned ISO food laboratory will deliver results on which important decisions are to be made at national level in Zambia regarding trade in the country's fisheries and associated products. Therefore, accreditation of the laboratory will enhance the public confidence in their test results and build the confidence in their products thereby increasing not only internal consumption of such products but also competitive entry into the international market.



⁵Importance and Benefits of ISO/IEC 17025 Accreditation. <https://cloudlims.com/blog/what-is-iso-17025-accreditation-and-benefits.html>

6.1.3 BETTER CONTAINMENT OF DISEASE OR EXOTIC FISH

The quarantine facility to be established under the project will serve to contain suspected disease fish or live fish samples for research in instances of suspected fish disease outbreaks. In some instances, where GRZ plans to introduce exotic fish to the water of Zambia, such fish species will be contained in the quarantine facility for study before possible introduction into the waters of the country.

6.1.4 OFFER SHORT-TERM EMPLOYMENT OPPORTUNITIES

The project will offer short-term employment opportunities in terms of local/unskilled labour and construction-based support services through which those who get such engagements. It is estimated that about 150 people will benefit in the project in terms of short-term employment opportunities. This would be a positive to the local community but short-term in nature and can be enhanced through publicizing available project work opportunities in public areas such as administrative centres in and around Kafue areas. However, such work will be availed to those above 15 years of age.

6.1.5 CONTRIBUTE TO ADDITIONAL INFRASTRUCTURE TO THE FISHERY SECTOR

Kafue Laboratory will comprise infrastructure delivering services fishery research services and in that, it will be an added facility constituting the enhanced capacity of the sector in the country.

6.1.6 SOURCES OF INCOME FOR VULNERABLE GROUPS ESPECIALLY WOMEN

The project will be an avenue in come to the women through sale off items to the workers there by enabling them earn additional source in come to support their families though this is to be a medium positive impact of short-term nature.

6.1.7 SOURCE INCOME FROM SALE OF LOCAL CONSTRUCTION MATERIALS

The project will provide a source of income through supply of construction materials such as cement, sand, rock-based materials and hardware items. Through these, the locals stand to benefit from the project. It is recommended that, extractable construction materials be sourced from suppliers who will be responsible for restoration of the sites and where the contractor directly extracts such materials, he/she will assume responsibility of ensuring acceptable restoration of the site.

6.1.8 PROVISION FOR A MUCH AND BETTER HANDSON HUMAN RESOURCE IN THE SECTOR

With the construction and equipping of the new research laboratory facility, the Ministry of Fisheries and Livestock will have in-house, a facility to develop its human resources in the sustainable management of fisheries which is likely to occur through enhanced in-service training opportunities for the laboratory technical and support staff.

6.2 PROJECT NEGATIVE IMPACTS

They will likely include:

6.2.1 IMPACTS RELATING TO SITE PREPARATORY WORKS

These are basically pre-construction activities in terms of site preparation works, removal of waste and site levelling works, setting out new structures and removal of demolition debris amongst others at the construction site will promote:

- a. Generation of dust which can be a public nuisance;
- b. Poor management of loose soils leading to erosion and siltation of stormwater drains; and
- c. Uncontrolled loss of vegetation/greenery and trees on the site beyond what is delineated for the project.

It is proposed that, works on the site be guided by the Resident Engineer to ensure works are done within the set out with his/her team which should include an Environmental Specialist. After project works, the construction areas should be restored and re-vegetated to the satisfaction of the Environment Officer of Kafue areas. In addition, the site will be secured with corrugated galvanized sheets.



Figure 7: Construction site sealed off with corrugated galvanized iron sheets (CGI).

6.2.2 VEGETATION LOSS

This is likely to arise through site preparation works in which, vegetation on the site will be cleared alongside the lawn grass at the site. This is likely to a small-scale and localized/site based negative impacts incite trees are of ornamental nature/planted and the grass is also routinely maintained. These impacts will be mitigated by:

- a. Restricting site clearance to mostly areas needed for infrastructure development;
- b. After works, the site be fully restored to allow for re-grassing with appropriate grass types; and
- c. The site be planted with ornamental plants with the guidance of Supervising Engineer and most important, the trees need not be planted close to foundations of buildings.

6.2.3 IMPACTS RELATING TO SOURCING OF CONSTRUCTION MATERIALS

Construction materials like stones, sand, etc. will have impact on the environment at their points of extraction including quarries and borrow pits. This is a small-scale, low magnitude and localized negative impact. The study proposes that, the contractors to the extent feasible should obtain construction materials from existing suppliers who take obligation to ensure extraction sites are

fully restored. However, where the contractor directly extracts construction materials from a site, then:

- a. Such a site be properly leased and all dues agreed with land owners be paid fully; and
- b. The site be restored fully and area environment officer confirms and certifies that, restoration has been satisfactorily done before effecting any outstanding payments.

6.2.4 EROSION CONTROL CONCERNS

This is likely to arise through site clearances and excavations works thereby exposing soil surfaces to rain and wind erosion though this will be a short-term, small-scale and minimal negative impact mainly occurring within the site. This can be mitigated through site restoration, planting of ornamental trees alongside rainwater harvesting measures. In addition, the project will put in place drainage channels to discharge storm water out of the facility and its environs.

6.2.5 IMPROPER MANAGEMENT OF CONSTRUCTION WORKS

At each healthcare facility, renovation activities will involve demolition and construction activities that might generate considerable waste comprising brick and concrete rubble, metal, glass cullet and timber waste. Improper disposal of construction waste could have environmental and public health impacts especially management of demolition rubble with possible friable construction materials.

Impact mitigation

- a. Contractors should undertake waste segregation at source to separate hazardous from non-hazardous waste;
- b. Construction waste such as metal scrap or wood waste which does not have any hazardous materials can be salvaged and handed to locals for various uses at household levels;
- c. Waste hoarding at site before disposal should be at designated places and considering site lay-out in order not to block any exit routes and emergency routes;
- d. The contractors should seek guidance of local government authorities on availability of acceptable solid waste disposal sites;
- e. Supervising engineers and area environment officers should ensure that contractors do not dump waste in non-designated areas. To effectively oversee this requirement, it is suggested that, area environmental officers should be facilitated to undertake active monitoring of works in the facilities; and
- f. Where applicable, Contractors must provide suitable containment and storage of chemicals and any hydrocarbons to prevent soil contamination and pollution to ground or water where such are likely to occur (surface and ground).

6.2.6 ACCUMULATION OF CUT-TOSPOIL

Which is likely to arise through excavation works and general works to with foundations at construction site which can be a source erosion and siltation. This is assessed as a medium negative impact whose implications can be mitigated through: re-use of the cut to spoil stuff for backfilling the foundations works with the approval of the Resident/Supervising Engineer. Any excess of such material can be given transported and disposed at a site approved and agreeable with area environment officer.

6.2.7 OILS POLLUTION AND SOIL CONTAMINATION

To minimize the potential for environmental contamination at the construction site, oil products used in vehicles and tracks should be stored in secure facilities with impermeable concrete floors. In addition, waste/leakage oil should be contained in oil separators in the camps or workshops. This

is a small-scale, localized but long-term negative impact with low chances of occurrences in the project.

6.2.8 ISSUES OF NON OR IRREGULAR PAYMENT OF WAGES AND SALARIES FOR THE WORKERS

The contractor has to provide the workers with contracts for their employment and such agreements should stipulate vividly terms and conditions of the employment and most important, what one is to earn, working terms, and implications. This is a medium negative impact and it is proposed that, it is to be mitigated through the project management co-opting the Kafue Labour Officer is to be part of monitoring team to ensure this requirement is observed.

6.2.9 POSSIBLE RISKS OF ENGAGING CHILDREN IN THE PROJECT WORKS

During the construction phase, the contractor is likely to engage children at construction sites as labourers which according to Zambian amounts to child labour and abuse and in contravention of the Child Statute as well as IL policies. According to provisions of the Employment of Young Persons and Children Act of Cap 268 of the Employment Act of Zambia, no person shall, except under conditions to be prescribed, employ or cause to be employed, any person under the age of fifteen years. And any person who contravenes the provisions of this subsection shall be guilty of an offence.

6.2.10 FAILURE TO CATER FOR SPECIAL USER NEEDS (ESP. PWDS).

The laboratory facility should be designed taking into account different user needs in terms of access and facilities inside. These will also include putting in place doors that can allow free movement of wheel chairs and toilets suited for people with disabilities (PWDs).



Figure 8: People with disabilities sanitary facilities

6.2.11 OCCUPATIONAL HEALTH SAFETY (OHS) RISKS

Construction activities at the construction site have potential to pose occupational risks some of which could be life threatening, for example, falling debris could injure workers if personal protective equipment (PPEs) are not provided or used. Working under hot sunny heat causes dehydration and stress to the workers. Back injury could also occur if workers lift heavy objects using inappropriate body postures. Other potential hazards might be: inadequate lightning or limited

level of visibility given sometimes while inside classrooms settings without adequate lights can lead to loss of attention and lack of concentration while working. In addition, workers might experience over-exertion, risk of slip and falls, exposure to confined spaces and excavations and exposure to chemicals, hazardous materials among others.

Mitigation strategies

- a. Orient all construction workers on safe work practices and guide lines and ensure that they adhere to them;
- b. Training should be conducted on how to prevent and manage incidences. This should involve proper handling of electricity, water etc. and sensitization on various modes of escape, conduct and responsibility during such incidences. All must fully be aware and mentally prepared for potential emergency;
- c. Use signage to warn staff and/or visitors that are not involved in construction activities especially danger areas;
- d. Supervision of works should be done regularly to ensure that safety conditions are met while any deviation from safety regulations is immediately reclaimed following the best practices regarding safety at work equipment;
- e. Restricting access to the site, through administrative controls, with a focus on minimizing access to risk works sites/structures or;
- f. Putting in place, evacuation procedures to handle any emergency situations that may arise on the site; and
- g. Provide adequate OHS protective gear for the employees at all times in terms of:

Hearing (Over 80 Decibels for 8 hours a day requires hearing protection)

- a. Ear Muffs: One size fits all, comfortable, less ear infection risk
- b. Ear Plugs: Small, lightweight, can get dirty and cause infection

Face/Eye (Working with any chemical or using any mechanical equipment)

- a. Face Shield: Protect face from splashing and particles
- b. Safety Glasses: Protection from solids (cutting, sanding, grinding)
- c. Safety Goggles: Protects eyes from splashing
- d. ***Hand*** (Use correct gloves for the job)
- e. Chemical Gloves: (nitrile, latex, PVC)
- f. Gloves for other use: special gloves for cutting, burning, abrasions/blisters

g. ***Body***

- h. Overalls: Can protect against dust, vapours, splashes

Foot Protection

- a. If electrical hazard present, ensure boots offer protection
- b. Safety Toe/Steel Toe Boots: Always worn when potential for falling hazards exists
- c. Water/Chemical Resistant Boots: Use in a spill situation
- d. Non-slip boots for working on wet/slippery floors.



Figure 9: Workers with basic PPEs in a construction site

6.2.12 IMPROPER MANAGEMENT OF CONSTRUCTION WORKS

At laboratory construction sites, the works to be undertaken will likely generate considerable waste comprising brick and concrete rubble, metal, glass cullet and timber waste. Improper disposal of such construction waste could have environmental and public health impacts especially management of demolition rubble with possible friable construction materials.

Impact mitigation

- a. Contractors should undertake waste segregation at source to separate hazardous from non-hazardous waste;
- b. Construction waste such as metal scrap or wood waste which does not have any hazardous materials can be salvaged and handed to locals for various uses at household levels;
- c. Waste hoarding at site before disposal should be at designated places and considering site lay-out in order not to block any exit routes and emergency routes;
- d. The contractors should seek guidance of local government authorities on availability of acceptable solid waste disposal sites;
- e. Supervising engineers and area environment officers should ensure that contractors do not illegally dump waste in non-designated areas. To effectively oversee this requirement, it is suggested that, area environmental officers from Kafue should be facilitated to undertake active monitoring of works in the facilities; and
- f. Where applicable, Contractors must provide suitable containment and storage of chemicals and any hydrocarbons to prevent soil contamination and pollution to ground or water where such are likely to occur (surface and ground).

6.2.13 RISKS OF HIV/AIDS-STI/STDS

The workers on the construction site can be prone to risks of Human Immuno Deficiency Virus/Acquired Immuno Virus/Sexually Transmitted Infections or Diseases (HIV/AIDS-STI-STDS). This can be triggered by workers getting on site and working alongside women. This can be mitigated by ensuring most local labour is sourced from within the project location to minimize risks of relocating labour from outside the project area. In addition, the contractor will liaise with an HIV/AIDS service provider who will conduct HIV/AIDS awareness sensitization as well as distribute condoms to the workers. Such a service provider will also conduct Voluntary Counselling and Treatment (VCT) services for the workers and also distribute anti-retroviral (ARVs).

6.2.14 WASTE TO BE DISPOSED BY A CONTRACTED WASTE HANDLER

It is the responsibility of all laboratory staff to properly segregate laboratory waste because different types of wastes have different treatment standards. All waste in the laboratory will hence be laid in the waste bins as per bin labels. Improper and irresponsible disposal of chemical wastes down drains, to the Local Authority refuse collection, or into the atmosphere is forbidden by law. The laboratories have separate bins for separate types of waste.

**Figure 10: Gloves and plastic based waste****Figure 11: Gels and fluid-based wastes****Figure 12: Metallic containers for sharps****Figure 13: Paper and paper-based wastes**

6.2.15 INCINERATION

All other items that are deemed unsuitable to be put in the normal waste bins in the laboratories, will be placed in a special waste-bin supplied in each of the laboratories and such items include: broken laboratory glassware, sharp objects of metal or glass, dirty sample tubes or other items lightly contaminated with chemicals and such will all be incinerated. Incineration will also be used to dispose used and obsolete laboratory reagents.



Figure 14: Typical incinerator that can be adopted for Kafue Laboratory

6.2.16 RISKS OF FIRES

Risks of fires in laboratories can be occasioned through spillages, irresponsible storage, handling and application of inflammable reagents, irresponsibly carrying around naked flames, smoking cigarettes and faulty electricity connections. All these will be addressed through Standard Operating Procedures (SOPs), having appropriate and functional fire extinguishers and skills in firefighting. Laboratory staff be regularly subjected to fire/rescue drills amongst others.

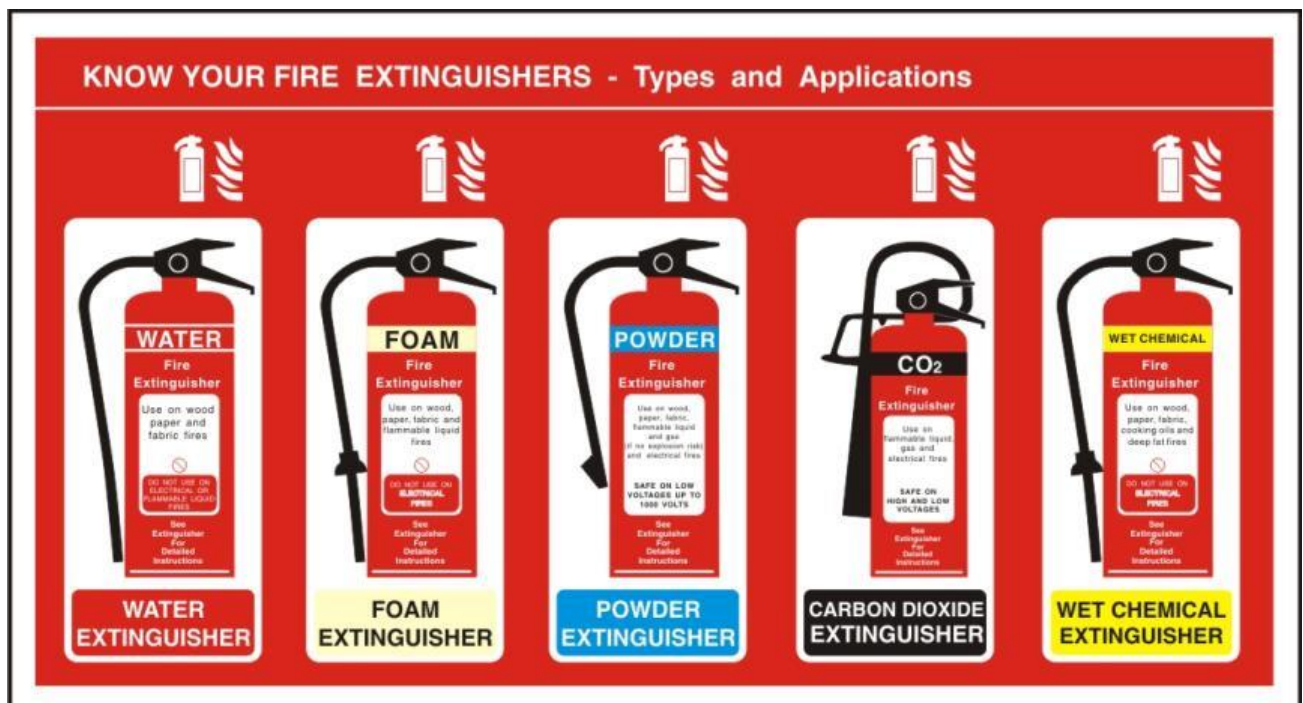


Figure 15: An array of fire extinguishers for use in a given fire situation

6.2.16.1.1 MANAGEMENT OF OBSOLETE AND EXPIRED REAGENTS

The Kafue Laboratory is to have in place, guidelines for its management and disposal of expired and obsolete reagents in line with operational procedures for similar laboratory establishments and that could include:

- a. At the end of every quarter (3 months), management of the laboratories prepare a list of materials which have expired;
- b. A chemical Disposal Form is filled with all key information which include: name of the chemical(s), its/their percentage purities, date at which the chemical expired. The same information is filled on a label and attached to the chemical intended for disposal;
- c. Such chemicals/reagents are placed in designated rooms i.e. rooms designated for waste storage, with the label facing outwards and clearly visible;
- d. Laboratory Manager will be informed of such chemicals intended for disposal; and
- e. The Laboratory Manager then informs the contracted licensed waste disposal agent who arranges for safe transportation and disposal of such wastes within a month of notifying him/her of such development.

6.2.16.1.2 PROCEDURE: EXPIRED SOLVENTS, WORKING REAGENTS AND MEDIA

- a. At the end of every month, check for time-sensitive reagents that have expired.
- b. Carefully drain non-hazardous solvents into the sinks labelled for chemical disposal. This must be done with continuous flow of water into the sink.
- c. Solid, non-hazardous chemicals are to be collected in polybags, tied and incinerated.
- d. Microbiological nutrient media waste will also be collected, gathered in a polybag and incinerated.

Good operational procedures for laboratories require that, Entities (Kafue Laboratory) should have measures to guide the purchase of its laboratories consumables in a manner that reduces wastage arising from unguided over-stocking resulting in mass expiry of consumables giving their challenge to be a burden.

6.2.16.1.3 MANAGEMENT OF REAGENTS SPILLS

Normal laboratory operations are to have workable strategies for managing reagents spills and as part of their Standard Operating Procedures (SOPs). When a spill occurs, the area is cleared of any users, and the spill cleaned up immediately. Waste from spill clean-up is then disposed of appropriately depending on the kind of chemical. After floor spill has been thoroughly cleaned up appropriately, the area is mopped dry to minimize the risk of slipping and falling. Other details are summarized in Annex 03.

6.2.16.2 EMERGENCY RESPONSE PROCEDURES FOR LABORATORIES

Spill clean-up procedures

The following spill clean-up procedure should be used.

- a. Put on gloves, a protective clinical coats and respirator.
- b. Re-enter the affected area.
- c. Cover the spill with cloth or paper towels to contain it.
- d. Pour an appropriate disinfectant over the paper towels and the immediate surrounding area (generally, 5% bleach solutions are appropriate).
- e. Apply disinfectant concentrically beginning at the outer margin of the spill and working towards the centre.
- f. Allow sufficient time for the disinfectant to act before clearing away any material for disposal. If broken glass or other sharps are involved, use a dustpan or a piece of stiff cardboard to collect the material and place it in a puncture-resistant container for disposal.
- g. Place other contaminated material in a sealed bag for appropriate disposal.
- h. Clean and disinfect the area of the spill.

Anyone who was exposed to the spill should be referred for medical advice; a record should be kept of the incident

Infectious spills (contained within a biological safety cabinet)

When a spill of infectious material occurs within a BSC, a clean-up procedure should begin immediately, and the cabinet should continue to operate;

- a. Place absorbent tissue over the spill area, and apply disinfectant solution liberally,
- b. If the walls of the BSC have been splashed, clean with a layer of absorbent paper towel liberally soaked in disinfectant solution,
- c. Leave affected areas covered with disinfectant for 30 minutes to 1 hour,
- d. Carefully collect contaminated sharps material, and place in a puncture-resistant container for disposal,
- e. Any equipment or reusable material (for example, centrifuge buckets) that has been splashed should be cleaned with the same disinfectant,
- f. Electrical equipment should be checked carefully before it is used; check the integrity of circuit breakers and earth-fault interrupters, and
- g. Collect other contaminated material in a sealed bag for appropriate disposal.

Breakage of tubes inside sealed buckets (safety cups)

Always use sealed centrifuge buckets, and load and unload them in a BSC. If breakage occurs during centrifuging, broken tubes must be discarded in a puncture-resistant container and disposed of immediately. Decontaminate centrifuge buckets by soaking them in a suitable disinfectant. Does not use bleach to disinfect metal parts because it causes corrosion. Alternatively, buckets may be decontaminated by autoclaving.

Spill clean-up kit

The laboratory facility management is responsible for maintaining spill response kits. Two spill response kits should be prepared: one placed outside the containment facility and one placed inside the facility. The kits should include the items listed below.

Spill response kit

- a. Hypochlorite solution stored in an opaque bottle (or another suitable disinfectant)
- b. Respirators
- c. Gloves
- d. Clinical coats (4-6 disposable coats)
- e. Dustpan and brush (for disposal if necessary)
- f. Chloramine tablets
- g. Paper towels
- h. Soap
- i. Sharps container
- j. Biohazard bags
- k. Goggles.

Autoclaving

An autoclave must be available on site in the vicinity of the laboratory to allow tubes and vials with cultures of to be sterilized prior to being removed for disposal. Separate autoclaves should be used to sterilize solutions or glassware (clean materials), and to decontaminate infectious materials.

The following materials are suitable for autoclaving:

- a. instruments, glassware, media or solutions for sterile use in the general laboratory;
- b. mycobacterial cultures for waste disposal; and
- c. all infectious materials from laboratories where mycobacterial culture is performed.

The time, temperature and pressure should be recorded each time the autoclave is run to monitor whether it is functioning properly. Biological indicators should be used regularly to validate the ability of the autoclave to achieve sterilization.

Disinfection

The killing action of disinfectants depends on the population of organisms to be killed, the concentration used, the duration of contact, and the presence of organic debris. Proprietary disinfectants recommended as suitable for use in laboratories are those containing phenols, chlorine or alcohol. These are usually selected depending on the material to be disinfected.

Phenol

Phenol should be used at a concentration of 5% in water. However, inhalation and dermal exposure to phenol is highly irritating to the skin, eyes and mucous membranes. Ingestion of phenol is considered to be toxic. Because of its toxicity and odour, phenol derivatives are generally used in place of phenol. Phenol solutions are used for decontaminating equipment and single-use items prior to disposal.

Chlorine

Chlorine is widely available. Sodium hypochlorite solutions (domestic bleach) contain 50 g/l available chlorine, and should therefore be diluted to 1:50 or 1:10 in water to obtain final concentrations of 1 g/l or 5 g/l. Bleach, either in stock or in solution, must be stored in a well ventilated, dark area. In good storage conditions, the 50g/l solution may last as long as 3 months; diluted solutions should be prepared daily. Bleach can be used as a general-purpose disinfectant and for soaking contaminated metal-free materials; because it is highly alkaline, it can corrode metal.

Alcohol

Alcohols, ethanol (denatured ethanol, methylated spirits) or isopropyl alcohol are used at a 70% solution. Alcohols are volatile and flammable, and must not be used near open flames. Solutions should be stored in proper containers to avoid evaporation. Bottles with alcohol-containing solutions must be clearly labelled so they are not autoclaved. A solution of 70% alcohol can be used on laboratory benches and BSCs for routine decontamination. A major advantage of aqueous solutions of alcohols is that they do not leave any residue on treated items. When hands become contaminated, a rinse with 70% ethanol or isopropyl alcohol followed by thorough washing with soap and water is effective.

Disposal procedures for contaminated materials

A system for identifying and separating infectious materials and their containers should be adopted. Categories may include:

- a. uncontaminated (non-infectious) waste that can be reused, recycled or disposed of in the same way as general household waste;
- b. contaminated (infectious) sharps, such as broken glass, syringes and slides;
- c. contaminated infectious material to be disposed of by burying, incinerating or autoclaving.

Broken glass and glass slides

Broken slides and used slides must be disposed of in a sharp's container. Containers for sharps disposal must be puncture-proof, have a fitted lid, and must not be filled to capacity. When they are three quarters full, they should be placed in containers for infectious waste and incinerated. Containers for sharps disposal must not be discarded in a landfill unless they have been incinerated or autoclaved. Used slides must not be reused.

6.3 DECOMMISSIONING PHASE

The economic life of the proposed project is expected to be between 50-80 years. At that point, the proponent shall have to vacate the site. The decommissioning exercise will have both positive and negative impacts:

During the decommissioning stage, demolition or renovations will be done, creating job opportunities for the youth. As well, rehabilitation works will be undertaken for the proposed project site to restore it to its original state. This will include replacement of the topsoil and re-vegetation, which will enhance the aesthetic value of the area. There will be need to employ people who will be involved in the reclamation of the site to near its original state.

The earth moving works during top soil replacement will lead to significant deterioration of the acoustic environment within the area and the surrounding areas. This will be as a result of the noise and vibration that will be experienced from machines and workforce being utilized. Dust will also be emitted affecting the surrounding environment. The proponent will put in place mitigation measures for noise and dust pollution during the decommissioning phase.

Table 12: ESMP for Kafue ZAEDP Laboratory operations

Environmental/Social Issue	Impact source/location	Mitigation Measures	Indicators	Agency Responsible for implementing the measures	Evidence to show implementation of mitigation measures	Frequency Of checking implementation	USD
Negative Impacts							
Failure to cater for special user needs (esp. PWDs).	Construction	Installation of PWDS wash rooms; Installation of ramps	PWDs wash rooms Installation of ramps	a. Contractor, Supervising Engineers b. ZAEDP PIU	Site Inspections	Continuous	Embedded in contract for works sums.
Loss of vegetation during site clearance works.	Construction site	a. Restrict clearance to areas for project works; b. Full restoration of sites after works; c. Planting trees on school compounds in the project; d. Caging of trees to keep off livestock; e. Diligent supervision of works site should be cleared after the rainy season	a. Guide on site clearing in place; b. BoQs with provisions for tree planting; c. N°. of trees planted d. Sites restored and re-vegetated.	a. ZAEDP PIU b. Kafue ZEMA c. RE/ Supervising consultants	Site visits Records and reports	Bi-monthly	10,000.000
Erosion control concerns	Construction Site	a. Watering of dusty places; b. Revegetate disturbed areas	Water browsers on site Revegetated areas on site	Contractors Supervising consultants.	Records and site visits	Continuous	Part of contract sum.
Traffic and associated impacts	Construction Site	a. Trucks transporting constructions materials should be covered with tarpaulins b. Provide OSH protective gears to workers c. Contractors	a. No on-site vehicle servicing b. Construction trucks with tarpaulin c. Traffic Management Plan d. Safety signage's on site e. Water browser	Contractors Supervising consultants.	Records and site visits	Continuous	Part of contract sum.

Environmental/Social Issue	Impact source/location	Mitigation Measures	Indicators	Agency Responsible for implementing the measures	Evidence to show implementation of mitigation measures	Frequency Of checking implementation	USD
		<p>should use fuel stations in Kafue areas for purposes of accessing oils and lubricants and not the site.</p> <p>d. Vehicle servicing and maintenance should be done outside the construction site.</p> <p>e. Sprinkling of water on access roads to control dust nuisance generation.</p>	f. Records of PPE supplied to workers				
Accumulation of cut to spoil	Construction site	<p>a. Re-use of the cut to spoil stuff for backfilling</p> <p>b. Foundations works with the approval of the Resident/Supervising Engineer</p>	Re-use of cut to spoil. Approval of construction works.	Contractors Supervising consultants.	Records and site visits	Continuous	Part of contract sum.
Risks of engaging Children in the Project Works	Construction site	Contractors should not employ child labour and abuse during construction works. Contractor should have a "No child labour policy"	Under age people on site	Contractor Supervising Engineer	Site visits Records and Inspections	Continuously	Embedded in contract sums for the project
Occupational Health Safety (OHS) risks	Construction site	<p>a. Orient all construction workers on safe work practices and guidelines.</p> <p>b. Training should be conducted on how</p>	<p>Evidence of training</p> <p>Onsite signage to warn staff</p> <p>Registration book for all people accessing</p>	Contractor Supervising consultants	Inspections and records.	Continuous	15,000.00

Environmental/Social Issue	Impact source/location	Mitigation Measures	Indicators	Agency Responsible for implementing the measures	Evidence to show implementation of mitigation measures	Frequency Of checking implementation	USD
		<p>to prevent and manage incidences.</p> <p>c. Use signage to warn staff and/or visitors that are not involved in construction activities specially danger areas.</p> <p>d. Strict instructions should be given for drivers of heavy equipment to observe speed limits.</p> <p>e. Restricting access to the site</p> <p>f. Provide adequate OHS protective gear for the employees at all times.</p>	the site				
Improper Management of construction waste	Construction site	<p>Routine removal of construction and demolition debris</p> <p>Dumper trucks to have tarpaulins to cover the rubble.</p> <p>Assessing the contents of hazardous materials and petroleum- based products in building systems</p> <p>Providing portable spill containment and</p>	<p>Rubble readily and routinely transported Outside the site.</p> <p>Dumper trucks with tarpaulins on.</p> <p>Complaints from the neighbourhood</p>	<p>Contractor, ZAEDP PIU.</p> <p>Supervising Engineer</p>	Records Inspections	Continuous	3,000,000

Environmental/Social Issue	Impact source/location	Mitigation Measures	Indicators	Agency Responsible for implementing the measures	Evidence to show implementation of mitigation measures	Frequency Of checking implementation	USD
		clean-up equipment on site and training in the equipment deployment					
Risks of HIV/AIDS STDs	Construction site	<ul style="list-style-type: none"> a. Providing surveillance and active screening and treatment of workers through Voluntary Counselling and Training (VCT) activities. b. Ensuring ready access to medical treatment, confidentiality and appropriate care c. Educating project workers and area residents on risks, prevention, and available treatment d. Conducting immunization programs for workers in local communities to improve health and guard against infection. 	Evidence of Voluntary Counselling and Training (VCT) activities.	Contractor Supervising consultants	Inspections and records.	Continuous	25,000.00
Improper usage or operations of the Facility	Operational	<ul style="list-style-type: none"> a. Keep laboratory facilities doors closed and access limited while working with infectious agents. 	<p>Biosafety signage's</p> <p>Restricted access to un authorised persons</p>	ZAEDP PIU	Inspections and records.	Continuous	Embedded in contract sums for the project

Environmental/Social Issue	Impact source/location	Mitigation Measures	Indicators	Agency Responsible for implementing the measures	Evidence to show implementation of mitigation measures	Frequency Of checking implementation	USD
		b. Biosafety sign posted on the door. c. All work must be performed in a BSC.					
Exposure risks for the workers and the public inside the laboratory	Operational	Infectious diseases should be handled with appropriate precautions	appropriate mouth masks. appropriate warning signs be posted on strategic areas. laboratory clinical respirators gloves	ZAEDP PIU	Inspections and records.	Continuous	Embedded in contract sums for the project
Liquid Waste Management (human excrement)	Operational	The constructed facility should be connected to the sewerage line and all public toilets should be connected to a sewer line	Proper liquid waste management	ZAEDP PIU Contractor Supervising consultants	Inspections and records.	Continuous	Embedded in contract sums for the project
Laboratory Waste Management and Disposal ❖ Management of broken glassware ❖ Laboratory Based Waste ❖ Management of discarded cultures and stocks.	Operational	Slides and used slides must be disposed of in a sharp's container Presence of proper management measures to prevent exposure to hazardous health-care waste Presence of laboratory's biosafety aspects	a. Containers for infectious waste and incinerated b. Proper solid waste on site c. Autoclaved containers on site. Plastic bag or container that can be autoclaved.	Laboratory Management	Inspections and records.	Continuous	Embedded in contract sums for the project
Fire risks in the laboratory facility	Operational	a. Installation of well serviced fire extinguishers on sites; b. Have emergency	a. Evidence of well serviced fire extinguishers on sites;	Contractor, Supervising Engineer Project Manager	Records Inspections	Continuous	18,000.00

Environmental/Social Issue	Impact source/location	Mitigation Measures	Indicators	Agency Responsible for implementing the measures	Evidence to show implementation of mitigation measures	Frequency Of checking implementation	USD
		<ul style="list-style-type: none"> c. Installation of warning signs against smoking at the facility; and d. Installation of fire assembly point within the compound. 	<ul style="list-style-type: none"> b. emergency plans on site; and c. Installation of warning signs 				
Management of obsolete and expired laboratory reagents General procedure for disposal expired reagents	Operational	<ul style="list-style-type: none"> a. All equipment should be disposed in accordance with the provisions of the Public Procurement and Disposal of Public Assets Act 2003 of Zambia. b. At the end of every quarter (3 months), management of the laboratories prepare lists of reagents which have expired; c. A chemical Disposal Form is filled with all key information which includes: name of the chemical(s), its/their percentage purities, date at which the chemical expired 	<p>Quarterly monitoring report. A chemical Disposal Form A licensed waste handler</p>	Contractor, Supervising Engineer Project Manager	Records Inspections	Continuous	Costs are part of project costs

Environmental/Social Issue	Impact source/location	Mitigation Measures	Indicators	Agency Responsible for implementing the measures	Evidence to show implementation of mitigation measures	Frequency Of checking implementation	USD
		<p>d. Such chemicals/reagents are placed in designated rooms;</p> <p>e. Laboratory Manager will be informed of such chemicals intended for disposal;</p> <p>f. Laboratory Manager then informs the contracted licensed waste disposal agent who arranges for safe transportation and disposal of such wastes within a month of notifying him/her of such development.</p>					
<p>Emergency response procedures for laboratory facility:</p> <ul style="list-style-type: none"> ❖ Infectious spills (outside a biological safety cabinet) ❖ Spill clean-up procedures ❖ Infectious spills (contained within a biological safety cabinet). ❖ Breakage of tubes inside sealed 	Operational	<p>a. A written emergency preparedness plan for dealing with laboratory incidents and accidents</p> <p>b. Put on gloves, a protective laboratory gown and respirator.</p> <p>c. Re-enter the affected area.</p> <p>d. Cover the spill</p>	<p>Respirators</p> <p>Gloves</p> <p>Laboratory gowns (disposable gowns)</p> <p>Dustpan and brush (for disposal if necessary)</p> <p>Paper towels</p> <p>Soap</p> <p>Sharps container</p> <p>Biohazard bags</p> <p>Goggles.</p>	Laboratory Management	Inspections and records.	Continuous	Embedded in the operations budget for the laboratory

Environmental/Social Issue	Impact source/location	Mitigation Measures	Indicators	Agency Responsible for implementing the measures	Evidence to show implementation of mitigation measures	Frequency Of checking implementation	USD
buckets (safety cups). ❖ Spill clean-up kit and Spill Response kit.		with cloth or paper towels to contain it. e. Place absorbent tissue over the spill area, and apply disinfectant solution liberally. f. Leave affected areas covered with disinfectant for 30 minutes to 1 hour. g. Carefully collect contaminated sharps material, and place in a puncture-resistant container for disposal. h. Any equipment or reusable material (for example, centrifuge buckets) that has been splashed should be cleaned with the same disinfectant. i. Electrical equipment should be checked carefully before it is used; check the integrity of circuit breakers and earth-fault interrupters. j. Collect other contaminated					

Environmental/Social Issue	Impact source/location	Mitigation Measures	Indicators	Agency Responsible for implementing the measures	Evidence to show implementation of mitigation measures	Frequency Of checking implementation	USD
		material in a sealed bag for appropriate disposal.					
Incineration	Construction and Operational Phase	<p>a. To incinerate hazardous waste properly requires an efficient means of controlling the temperature, and a secondary burning chamber.</p> <p>b. Training of incinerator operator.</p>	Evidence of training	ZAEDP PIU and Laboratory Management	Inspections and records.	Continuous	Embedded in contract sums for the project
Autoclaving Disinfection	Operational Phase	a. Instruments, glassware, media or solutions for sterile use in the laboratory.	<p>Sterilizer Machine in place</p> <p>Colour coded waste bins</p>	Laboratory Management	Inspections and records.	Continuous	Embedded in contract sums for the project
<p>a. Disposal procedures for contaminated materials</p> <p>b. Broken glass and glass slides</p> <p>c. Contaminated or potentially infectious materials for disposal</p>	Operational Phase	<p>a. Uncontaminated (non-infectious) waste that can be reused, recycled or disposed of in the same way as general household waste;</p> <p>b. Contaminated sharps, such as broken glass, syringes and slides; and</p> <p>c. Contaminated infectious material to be disposed of by burying, incinerating or</p>	<p>Autoclaved containers</p> <p>Colour coded waste bins</p>	Laboratory Management	Inspections and records.	Continuous	Embedded in contract sums for the project

Environmental/Social Issue	Impact source/location	Mitigation Measures	Indicators	Agency Responsible for implementing the measures	Evidence to show implementation of mitigation measures	Frequency Of checking implementation	USD
		autoclaving.					

6.4 ENVIRONMENTAL AND SOCIAL MONITORING PLAN

The primary role of monitoring and supervision of project environmental and social compliance will fall squarely in DoF, Project Staff and Kafue Environment Team under ZEMA. This expertise is to be brought on board to oversee specific aspects of the project during its implementation to ensure compliance. In addition, the contractor will be required to have an environmental and social management plan to facilitate self-monitoring of impacts and implement recommended mitigation measures, during the construction and the defects liability phase. Under these phases, the contractor shall hire/employ an Environmental, Health Safety (EHS) Specialist as part of his employees. During the operation phase, the Supervising Consultant/Resident Engineer will play a role to ensure the mitigation measures are implemented.

Key Monitoring Indicators

The proposed monitoring indicators will include:

- a. Vegetation loss and remedial restoration measures instituted;
- b. Noise pollution control measures in place and how they operate;
- c. Erosion control measures
- d. EPR measures in place and their operations.
- e. OHS measures for workers and the laboratory staff
- f. Public health observance in the operations of the laboratories.
- g. Waste management measures.
- h. First Aid Facilities in place and how they operate.
- i. HIV/AIDS interventions and related sexual behaviours among workers.
- j. Capacity building programs and how they have been undertaken.
- k. Labour recruitment.

6.5 CAPACITY BUILDING IN ZAEDP LABORATORY FACILITY

This will entail tailor made in-service trainings for the operations of the laboratory's technical personnel in the areas of mainly Environmental Health and Safety. The training is deemed necessary to refresh an orient staff understanding key safety aspects while working in the laboratory and should cover aspects such as:

- a. Biosafety Training
- b. Hazard-Specific Safety Training
- c. ISO Certification Training
- d. Hazardous materials and/or equipment in laboratory operations.
- e. Understanding inherent laboratory-based risks and how to mitigate them.
- f. EPR in the laboratory
- g. Understanding roles and responsibilities in health and safety aspects in the medical operations.
- h. Biosafety and regulatory compliance requirements in the medical operations.
- i. Rules and regulations in the laboratory operations.

6.6 DECOMMISSIONING AND CLOSURE

The economic life of the proposed project is expected to be between 50-80 years. At that point, the proponent shall have to vacate the site. The decommissioning exercise will have both positive and negative impacts:

During the decommissioning stage, demolition or renovations will be done, creating job opportunities for the youth. As well, rehabilitation works will be undertaken for the proposed project site to restore it to its original state. This will include replacement of the topsoil and re-vegetation, which will enhance the aesthetic value of the area. There will be need to employ people who will be involved in the reclamation of the site to near its original state.

The earth moving works during top soil replacement will lead to significant deterioration of the acoustic environment within the area and the surrounding areas. This will be as a result of the noise and vibration that will be experienced from machines and workforce being utilized. Dust will also be emitted affecting the surrounding environment. The proponent will put in place mitigation measures for noise and dust pollution during the decommissioning phase.

The Decommissioning phase shall ensure proper management of laboratory reagents and inoculants such that, they are not split around and some escaping to the environment in case of those which are hazardous. The site will be disinfected to free it from possible pathogens and contaminants.

Table 13: Decommissioning and rehabilitation costs

Item.	Activity	Cost (USD)
1.	Conducting a soil contamination study	1,000
2.	Treatment of contaminated soils	2,500
3.	Demolition of structures	26,500
4.	Re-profiling the land	3,500
5.	Contingency	2, 500
Total Cost		USD 36,000

A total approximated cost of **USD 16,000** will be spent on decommissioning and closure costs.

7 CONCLUSIONS AND RECOMMENDATIONS

- a. The proposed facilities are very vital in the support to the health and safety aspects in the marketing of fish both in the local market as well as export market. The international fish market (especially the European Union-EU) has very stringent fish standards which can be met by having in place, a laboratory of this scale to facilitate maintenance of standards in the fishery sector;
- b. The project once accomplished is well placed to support research in the area of fish diseases thereby ensuring, the country fish is free of disease and fit for consumption. The project facility stands to support research into grey-areas in the science of fish thereby contributing to generation of a pool of knowledge to needed for the growth of sector to meet protein growing needs in the country;
- c. Establishment of the Quarantine facility will offer control and confined environment to hold fish imported for introduction into the waters of Zambia as well as management of suspected diseased fish for scientific observations during while investigations into such possible diseases' outbreaks;
- d. That aside, it is also clear that, construction of these facilities will likely have negative environmental and social impacts which have been assessed to be of minimal negative scale and can be managed through implementation of the Environmental and Social Management Plan as well as Monitoring Plan;

The project should provide a modest budget for construction on an Incinerator for hazardous laboratory waste management.

The proposed project will be meeting the needs for provision of quality food safety and aquatic testing and quarantine services in the country and at the same time serve as a worthwhile investment for the Ministry of Fisheries and Livestock in the improving the aquaculture subsector. Overall, the proposed development has a number of multiplier benefits cascading development fronts and the country is poised to benefit in terms of competitive fish exports as well as meeting domestic and regional demands.

8 DECLARATION OF AUTHENTICITY OF REPORT CONTENTS

We do hereby declare that the information presented herein regarding the Environmental Project Brief Report for the proposed Construction of a Food Safety Laboratory, National Aquatic Animal Health Laboratory and Quarantine Facility in Kafue District by Zambia Aquaculture Enterprise Development Project (ZAEDP) was collected from an Environmental and Social Impact Assessment undertaken in project area led by a team of consultants from Kaizen Consulting International in association with JBN Consult & Planners under the Project Team Leader Nelson Omagor in accordance with the Environmental Management Act No 12 of 2011 read with Environmental Impact Assessment Regulations S.I. No. 28 of 1997 and from authentic sources of literature.



Signature: _____

Nelson Omagor
ESIA Team Leader
KCI in Association with JBN

Signature: _____

Name: _____

Title: _____

Ministry of Fisheries and Livestock
Mulungushi House
3rd Floor Mid and West Wing
P.O Box 50060, Lusaka

Zambia Aquaculture Enterprise
Development Project

9 DECOMMISSIONING AND CLOSURE PHASE

At closure, all project equipment will be removed. The impacts associated with the closure and post closure of the project are summarised below.

9.1 SOCIO-ECONOMIC IMPACTS

9.1.1 LOSS OF REVENUE

The decommissioning and closure of the project will bring to an end the source of income for the employees. This is likely to have a significant impact on the living conditions of the people. ZAEDP will therefore put in place a mechanism to prepare employees for life beyond the project. Employees will be prepared by providing them with skills and other income generating avenues.

Impact on public health

The unburied ponds at the site can provide a breeding ground for mosquitoes and inevitably lead to high incidences of malaria. In addition, ponds could pose a potential physical hazard of injury in the event someone fell in. At closure, all ponds will be buried, the site re-profiled and re-vegetated.

9.2 ENVIRONMENTAL IMPACTS

Visual impact Inappropriate decommissioning and closure may leave the site significantly altered and may also contribute to the modification of the site environs. However, with appropriate decommissioning and closure practices, the final visual feature at the site will not be seen following site reclamation and rehabilitation of the area upon cessation of the fish project.

ZAEDP will implement site rehabilitation at closure. The main objectives of this activity will be:

- Promote alternative economic activities in the area that are sustainable in the future;
- Ensure the safety of surrounding communities through public consultation and the erection of warning signs.
- Promote an alternative sustainable land use; and
- Prevent potential significant adverse effects on adjacent water resources, being groundwater and surface water.

Discussions and negotiations will be held with the community and the local council regarding the possibility of using some buildings for other sustainable uses during post closure.

9.2.1 SITE INFRASTRUCTURE

The area will be re-profiled to establish the natural drainage pattern. All reusable and recyclable materials and scrap of good value will be salvaged and sold off while office buildings will be left intact and used for other purposes. Some concrete foundations will be retained for use as foundations for future buildings if required. The following plant and equipment dismantling and disposal practices will be applied:

- Removal of all brick buildings;

- Breaking out and removal of all concrete foundations;
- Removal of steel frames;
- Demolish reinforced concrete structures and dispose of them on-site;
- Remove electrical equipment, pumps, motors, and other fixed equipment;
- Remove any fuel storage tanks;
- Cut up and remove all steel tanks and vessels;
- Dig up and remove all below ground electricity cables;
- Remove all mechanical equipment;
- Clear materials handling areas of all raw materials; and
- General site clean-up.

Site levelling and re-profiling will be done to re-establish the natural drainage pattern across the site, after which, the site will be re-vegetated with indigenous grasses and trees. Septic tanks will be connected to the soak-away system for the treatment of sewage. All materials and equipment that cannot be reused recycled or sold will be disposed of at an approved non-hazardous disposal site.

9.2.2 PLANT SITE DRAINAGE SYSTEMS

After cessation of operations, all ponds and drainage channels will be re-profiled with the additional soil amendment material such as rock from elsewhere, previously stripped topsoil and organic matter and re-vegetated.

9.2.3 REHABILITATION EARTHWORKS

The re-shaping and grading of a site is essential for rehabilitation to ensure that the final landform is hydrologically compatible with surrounding areas. This entails making slopes stable and less prominent.

9.2.4 EROSION CONTROL

A major objective of rehabilitation will be to establish an adequate cover of vegetation to stabilise the site and prevent or control erosion. Before a vegetation cover is established, wind erosion will be controlled by three basic methods:

- Protecting the soil surface with a mulch of natural or manufactured materials;
- Maintaining the soil in an erosion resistant condition (i.e. moist); and
- Reducing wind velocity across the disturbed areas by establishing wind breaks.

The soil will be protected from water erosion by the following measures:

- Drainage from external catchments will be controlled by diversion channels or holding structures such as banks and drains;
- Slowing the water flow across the soil surface; this will be done by encouraging infiltration and channelling water offsite. Infiltration will be encouraged by ripping the soil to relieve the soil of compaction, increase the volume of soil readily accessible to plant roots and bind the topsoil to the subsoil.
- Reducing the impact of raindrops on the soil surface by provisions such as mulching; and
- Maintaining the soil in an erosion resistant condition.

9.2.5 RE-VEGETATION

For the purposes of re-vegetation, a nursery of indigenous plant tree species will be established on site for progressive and end of project re-vegetation of closed stable areas. If this does not work out, the company will buy young tree species from the Forestry Department. All the preparatory works will be completed before the time when the seeds are most likely to experience the conditions they need to germinate and survive such as reliable rainfall and suitable temperatures.

The time for successful re-vegetation of all relevant areas of the project area is about 5 years post closure.

9.2.6 CONTAMINATED SOIL

ZAEDP will carry out soil contamination surveys. The soil survey will involve test pitting, soil sampling and analysis. The number and location of test pits will be based on a site walkover/inspection at closure to identify potentially contaminated soils. A deeper soil inspection may be necessary at specific hotspots (pollution sources) depending on the findings of the near surface soil survey.

9.2.7 MONITORING

The following success criteria will be monitored periodically:

- Physical (stability, resistance to erosion, re-establishment of drainage);
- Biological (species richness, plant density, canopy cover, seed production, fauna return, weed control, productivity);
- Water quality standards for drainage water; and
- Public safety issues

Developmental projects are usually temporary in nature and after a certain period of operation, all the cages, ponds and associated infrastructures will be decommissioned and the sites closed. It will be important that activities during this phase are carried out in an environmentally sound manner, leaving as little impact as possible on the environment.

- To this end, a decommissioning and closure plan will be developed. The main objectives of the plan will be to:
- Promote alternative economic activities in the area that are sustainable in the future;
- Ensure the safety of surrounding communities through public consultation and the erection of warning signs.
- Return the land to conditions capable of supporting the former land use, or where this is not practical, or feasible, an alternative sustainable land use; and
- Prevent potential significant adverse effects on adjacent environs.

10 REFERENCES

- a. Cooperation Agency (JICA), Ministry of Local Government and Housing, Republic of Zambia.
- b. CSO, (1996). Zambia Demographic and Health Survey. Republic of Zambia. Central Statistics Office. North Western
- c. CSO, (2000). Census of Population and Housing. Republic of Zambia. Central Statistics Office. North Western
- d. CSO, (2003). Zambia 2000 census of population and housing: Population Projection Report. Republic of Zambia. Central Statistics Office. North Western.
- e. CSO, (2011). Zambia 2010 census of population and housing: Preliminary Population Figures. Republic of Zambia. Central Statistics Office. North Western.
- f. ECZ, 2006: The Zambia Environmental Outlook report for 2006
- g. Explanation of Degree Sheets 1527, SE. Quarter and 1528, SW. Quarter. Government Printer, North Western
- h. GRZ, 2011: The Environmental Management Act No. 12 of 2011
- i. GRZ, 2011: The Water Resources Management Act of 2011.
- j. Heisler, H. (1974) Urbanization and the Government of Migration, C. Hurst and Company, London.
- k. MTENR, 2004: Environmental Policy Development: North Western Province Situation Analysis
- l. Nippon Koei (2001). The Study on Environmental Improvement of Unplanned Urban Settlements in North Western. Final Report Volume-2; Main Document. Japan International
- m. Simpson J.G., Drysdall A.R. and Lambert H.H. (1963). The Geology and Groundwater

11 APPENDICES

11.1 APPENDIX 1: GUIDELINES FOR HANDLING AND MANAGEMENT OF CHEMICAL SPILLS IN THE LABORATORIES (LABSOPS 3/2014)

Purpose: This document outlines procedures for the management of chemical spills that may occur in the laboratories. It is meant to ensure that chemical spills are cleaned up immediately and appropriately, to minimize the effects of such chemicals on health, ensure safety from exposure to such spills and to reduce their impact on the environment.

Scope: These guidelines apply to all workers and others who use, transport and store chemicals in the Bioscience laboratories adopted from best practices.

Definitions: Safety Data Sheets (SDS) provide workers with information such as physical data (melting point, boiling point, flash point, etc.), toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill-handling procedures. Personal Protective Equipment (PPE) are devices worn by the worker or laboratory attendant to protect against hazard in the laboratory.

General: A worker handling a hazardous chemical should be aware of the correct procedures in the event of a spill. This information can be sourced through an SDS and if necessary, explicitly detailed in a documented safe work procedure. Controls, such as double containment, bunding, drip trays or raised edges around work areas, must be in place to minimize the effects of a chemical spill. Spill management and response strategies should be included during laboratory emergency planning with personnel trained in the procedures. A quick response by laboratory personnel to a chemical spill is likely to limit the consequences, whether it is a minor or major spill. All laboratory workers must wear appropriate PPE when attending to a chemical spill. The PPE can be lab coats, gloves, safety glasses, goggles, face shields or respirators as appropriate to the risk.

Defining Major or Minor Spill: Spills will be either minor or major, depending on the volume, location and hazard of the substance spilt (Figure 55). will be used to categorize spills into major or minor.

Minor Spill Responses

- a. Ensure you are wearing correct PPE to respond to the spill: Chemically resistant safety gloves, goggles, enclosed footwear, cotton laboratory coat, respirator with filters appropriate for the spilt chemical. -Always check the SDS for specific PPE requirements;
- b. Immediately notify others in the area of the spill. Corridors and pathways have a lot of traffic so it is important to alert passers-by of the spill and ensure the area is kept free of traffic;
- c. Identify the chemical/s and hazards involved (SDS, label) and use the information on the physical and chemical properties of the material to judge response;
- d. If there is chemical exposure to a worker, respond as quickly as possible to administer appropriate first aid.
- e. Approach with care - many harmful chemicals lack colours or offensive odours. Avoid breathing vapours from the spill. Never assume the chemical is harmless;

- f. Control the source spillage;
- g. Contain the spill with a barrier or use appropriate absorbent material from the spills kit;
- h. Clean up promptly and thoroughly and neutralize any acids/alkalis;
 - Decontaminate the affected area, equipment and clothing and dispose of any contaminated material appropriately; and
 - Review area when decontamination is complete. Check walkways, floors, stairs, and equipment for contamination or damage.

Major spill responses

- a. **Protect yourself:** Don't touch harmful substances. Be aware that fumes may pose a risk.
- b. **Evacuate the laboratory:** If possible, as you leave, close doors to prevent further contamination and turn off any ignition sources.
- c. **Isolate and control access to the spill area:** Do not allow non-essential personnel to enter the spill area.
- d. **Raise the alarm:** Contact the Laboratory Manager, supervisor or nearest scientist. If necessary, Emergency support services can be contacted.
- e. **Apply First Aid:** If necessary, source the SDS for the chemical and treat contaminated individuals as per the SDS. If required, summon a First Aid Officer, or ambulance. Isolate affected persons and keep on site.
- f. **Decontaminate:** In conjunction with expert assistance, minimize the spread of contamination and commence clean up procedures.
- g. **Review:** Once the clean-up is complete, review the area.

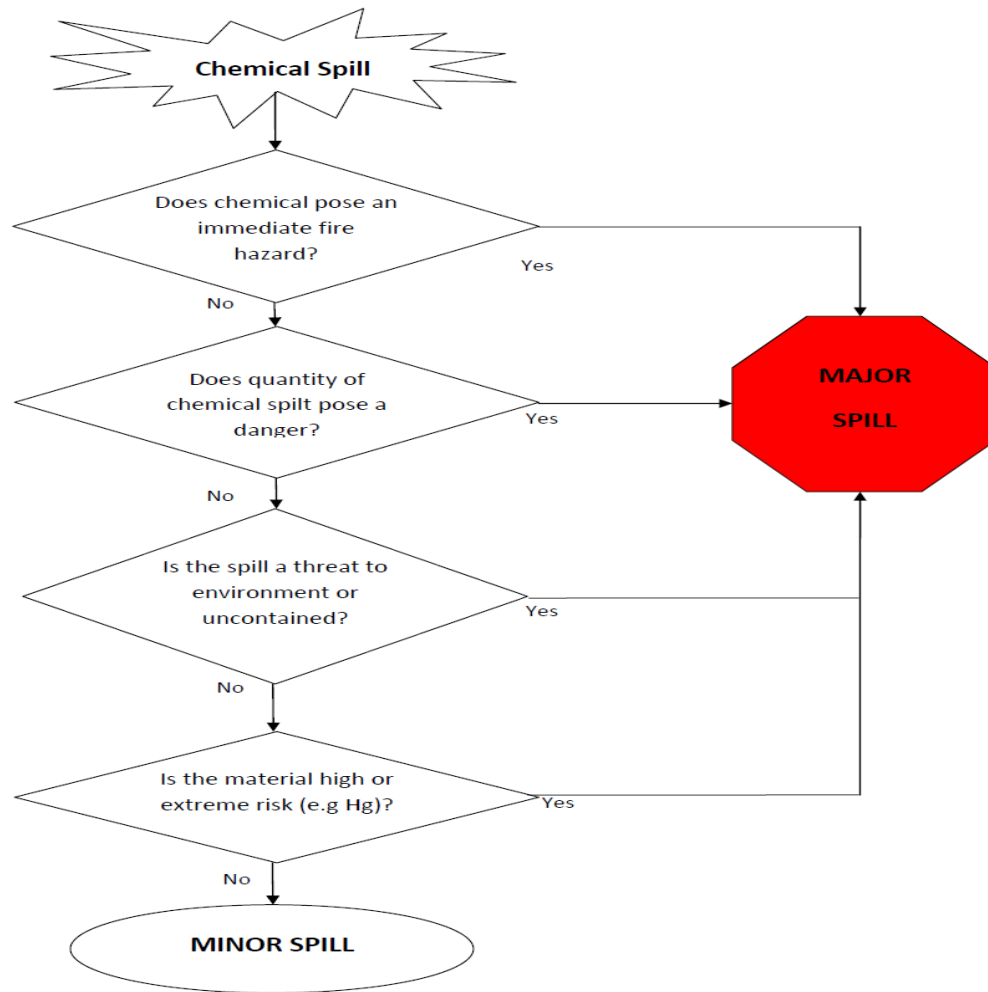


Figure 16: Decision criterion for categorizing spills into either major or minor.

Generic Chemical Spill Response

Substance	Recommended Action
Organic Chemicals	<ol style="list-style-type: none"> Use an absorbent such as vermiculite Place spent vermiculite in a sealed labelled container for waste disposal by a licensed contractor Flammable solvents can be cleaned up with absorbent rags and then placed in fully open headed drums that are sealed, suitably labelled.
Oxidizing acids	<p>Warning. Do not use paper towels</p> <p>The safety data sheet must always be consulted when dealing with these types of spills. In particular the hazards of the chemical (including acute and chronic health effects), reactivity information, safety precautions for handling and specific information for dealing with spills.</p>
Acids	<ol style="list-style-type: none"> For small spillages of acids use dry sand or carbonate to contain spill. The area should be flushed with water but not to the extent that the spillage is spread unnecessarily. Neutralize an acid with sodium bicarbonate by sprinkling generously over spill. Laboratory Spill Kits should contain soda ash (sodium bicarbonate) to sprinkle liberally over the spill. If necessary, wear a P1 mask to avoid breathing soda ash dust.
Alkalis	<ol style="list-style-type: none"> Contain the alkali spill using dry sand or neutralizer. Neutralize with boric or citric acid before clean-up. Residual alkali should be washed with water ensuring no contact. Laboratory Spill Kits should contain boric acid to sprinkle liberally over the spill. If necessary, wear a P1 mask to avoid breathing soda ash dust.

Figure 17: Generic Chemical Spill Response

11.2 APPENDIX 2: VALIDATION WORKSHOP

Validation Workshop on Environmental Assessment and Aquaculture Infrastructure Designs held on 28th January 2020 at Twangale Park, Lusaka

1.0 Introduction

As part of the stakeholder consultation meeting a validation workshop was held to discuss the findings from the environmental assessment and aquaculture infrastructure designs for Zambia Aquaculture Enterprise Development Project. The meeting was called to order at 09:15 hours by the Deputy Director Fisheries Department, welcomed the participants present.

This was followed up with self-introduction by the participants and tea break.

2.0 Presentations

There were two presentations expected for the workshop. However, due to the absence of Delta Engineering Company who were supposed to give the opening presentation on Aquaculture Infrastructure Designs, Kaizen Consulting International presented their report on environmental assessment first.

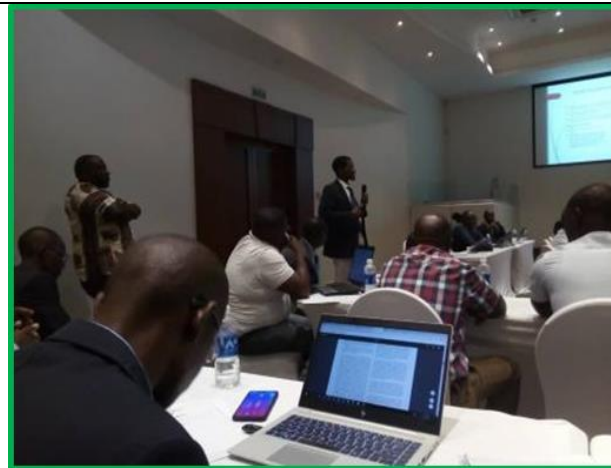


Figure 18: Mr Jacob Chishiba – Policy Framework presentation



Figure 19: Mr Willie Kalunga - Biological resources presentation



Figure 20: Mr Chisha Chanda - Water resources presentation

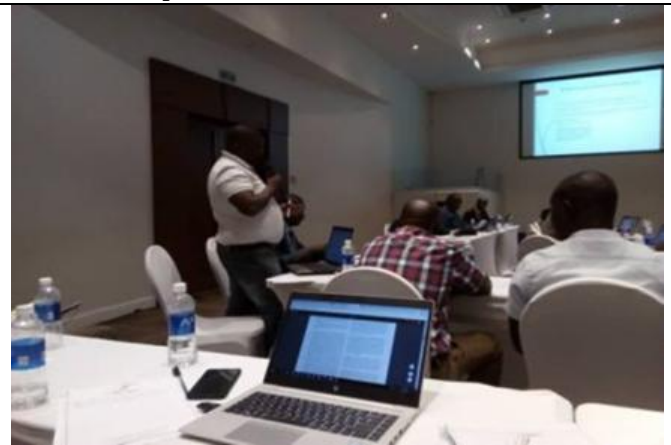


Figure 21: Mr Jones Mulomba - Social Economic presentation

ZAMBIA AQUACULTURE ENTERPRISE DEVELOPMENT PROJECT ENVIRONMENTAL ASSESMENT AND AQUACULTURE INFRASTRUCTURE DESIGNS VALIDATION WORKSHOP 28TH JANUARY, 2020 AT TWANGALE PARK

NO.	NAME	POSITION	ORGANISATION	CONTACT	E-MAIL
1	ESONTER G. MUSIKA	LECTURER	CRU - KNU	0978622865 0964545651	c3musika1962@gmail.com
2	CHIMWALI HERBERT	Production Manager	Kaloko Harvest Ltd	0977165546	herbertchimwali@gmail.com
3	VICTOR MANDA	Consultant	CISSER	0978745553	victormanda@ciisser.com
4	NAMIANI H. KAYUMU	PFO	MFL - DDF	0978076117	namiani.h@yaho.com
5	CHILEMBO JACOB	DFO	MFL - DDF	0979500853	chilembojacob@yahoo.com
6	DANIEL PRECIOS	DFO	MFL - DDF	0977624133	danielprecios@yahoo.com
7	MACHISO PHWI	A/PFO	AMAFWA - DDF	096541010	machisophwi@yahoo.com
8	FELEWEZA ANITA	F.C	DDF/MFL	096873568	felewezaanita@yahoo.com
9	KAGEGI MUYABALI	PFO	DDF - LUAKA	0977414251	muyabali@yahoo.com
10	ALICK G. MBEWE	PFO	DDF - SONGELA	0977696030	alickgmbewe@yahoo.com
11	Lumbwe Kalumba	A/CARU	MFL - DDF HQ	0977816006	kalumbakalumba@yahoo.com
12	MBAWAI MBEWE	CFO	FISHERIES HQ	0977693026	mbawaimbe@yahoo.com
13	MALINDA M. MWALE	A/PFO	DDF SOUTHERN	0977127769	malindamwale@yahoo.com
14	KONDANANI MITI	PRD OFFICER	ZAEDP	0962487998	kondanani_miti@yahoo.com
15	HARRIS PHIRI	D/DIRECTOR	DDF - HQ	0977649148	harrisphiri@live.com

NO.	NAME	POSITION	ORGANISATION	CONTACT	E-MAIL
16	CYPRIAN KATONGO	PROFESSOR	UNIVERSITY OF ZAMBIA DEPT. OF BULLETS	097765216	ckatongocyprian@gmail.com
17	JOHN KILANGE	DEPT. MANAGER	POSTNET	0955817924	john.kilange@gmail.com
18	EVANS MUTANUKA	CFO	DDF	0977869080	evansmutanuka@yahoo.com
19	MULLEWA SIMON	MANAGER	ADAZ	097840076	mullewa@gmail.com
20	SAMUEL NYONGI ZIKIJA	DFO	DDF - MFL	0973310230	gabrielzikija@yahoo.com
21	ARTHUR MBUZI	DFO	MFL - DDF	0977466946	arthurmbuzi@yahoo.com
22	JONES K. MULEMBA	CONSULTANT	KAIZEN	0976271130	mulembajones@yahoo.com
23	WILHE KALUKA	CONSULTANT	KAIZEN	0972857994	wilhekaluka@yahoo.com
24	JALUS CHISHIKA	CONSULTANT	KAIZEN	0972028591	jaluschishika@yahoo.com
25	MWANGI KIMBONI	JFC	MFL	097876755	mwangikimboni@yahoo.com
26	TISAH ZIWA	STRUCTURAL DPI/ENGINEER	DPI - MHI	0965897662	zwatisah@yahoo.com
27	OLIVER MUYEZA	MANAGER	KAIZEN	0962415508	olivermuyeza@yahoo.com
28	FRANCIS CHIMPANGU	Project facilitator	FAO	0977892356	francischimpangu@fac.org
29	LINDA MUYANGWA	Subsector Advisor	MFL	0975321203	linda.muyangwa@yahoo.com
30	MARY KANDA NG'ANDA	SPSO	MFL	0977717365	marykanda@yahoo.com

NO.	NAME	POSITION	ORGANISATION	CONTACT	E-MAIL
31	NZILA SICALIMBA	V. Chair	ZACDSC	097197008	nzilasilica@gmail.com
32	MALILI A. NARANZIKA	SEC. CO-ORDINATOR	ZAEDP/MFL	0976196446	malilinananzika@gmail.com
33	ELIZABETH B. PHIRI	CO-ORDINATOR	ZGMA	0955227321	etoburda@gmail.com
34	FREZARIB SIMFUKWE	FAO PROJECT	ZACDSC	0977821664	frezarib@gmail.com
35	Alexander Mwiye	PA - MFL	ZAEDP/MFL	097725600	alexandermwiye@yahoo.com
36	Patrick Ngalande	Director	MFL - DDF	097788733	ngalande@yahoo.com
37	MUTHIGA CHARLO	DD - TRS	MFL - RB	0969116555	muthiga60@gmail.com
38	VASIC S. SIKANYE	DIRECTOR	ZACS	0966460821	sikanyev@yahoo.com
39	Chanda Chisali	CHAIRMAN	KAIZEN	0967482349	chanda_chisali@yahoo.com
40	TERRY M. KASANGA	MANAGER	YALLO LTD	0962031620	terrykasanga@yahoo.com
41	Mweene Lizen	NGE	ZAEDP	0971529845	mweenelizen@gmail.com
42	JOHN D. MUDENDA	MANAGER	LEAFINATE FALMS	096771938	johnmudenda@yahoo.com
43	FISHE P. MWALE	CHAR	ADAZ	0977335201	f.mwale@yahoo.com
44	NAMACHIMBA Chumba	FRO	ZAEDP	0977547268	namachimba@gmail.com
45	Nolani Chilengi	Admin Assistant	ZAEDP/DDF	0966461611	nolanichilengi@gmail.com

11.3 APPENDIX 3: SITE PLAN

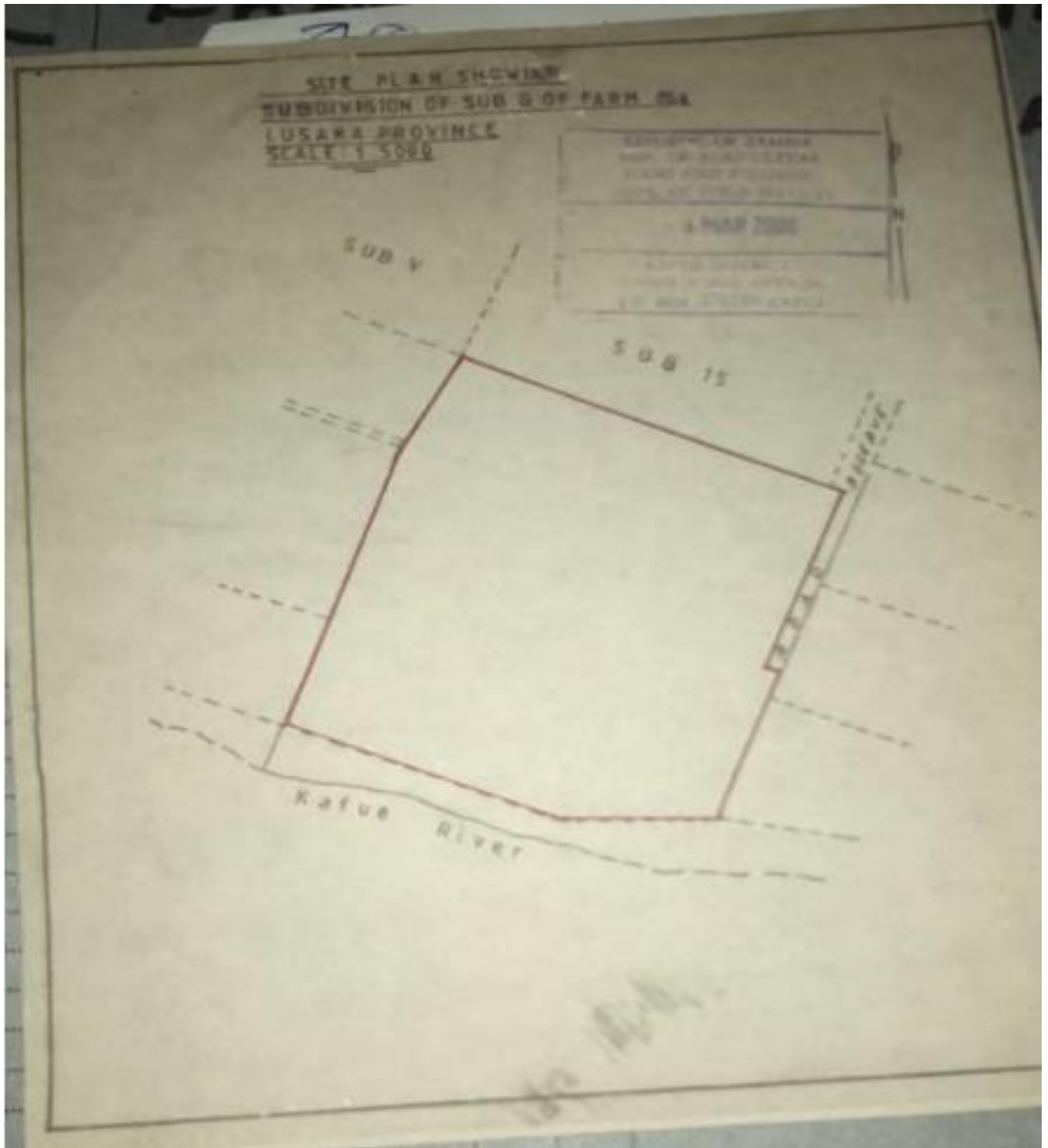


Figure 22: Site Plan

All correspondence should be addressed to
Principal
Mobile: +260 972542982/0955 308627

KFT/103/141/18



REPUBLIC OF ZAMBIA
MINISTRY OF FISHERIES AND LIVESTOCK

KASAKA FISHERIES TRAINING INSTITUTE
P.O BOX 360079
KAFUE

20th January 2020

The Provincial Fisheries Officer
Ministry of Fisheries and Livestock
P.O. Box 35301
LUSAKA



**RE: AUTHORITY TO CONSTRUCT KAFUE AQUACULTURE SERVICE CENTRE
AND ZAMBIA AQUACULTURE RESEARCH INSTITUTE**

Reference is made to the above subject matter.

Following the request you made to use part of Kasaka Fisheries Training Institute land for the construction of Kafue Aquaculture Service Centre and Zambia Aquaculture Research Institute; I, therefore, inform you that your request has been granted.

Looking forward to the development coming forth

Yours faithfully

Justina Kasabila-Kalekanya (Mrs)

Ag/ PRINCIPAL

KASAKA FISHERIES TRAINING INSTITUTE-KAFUE

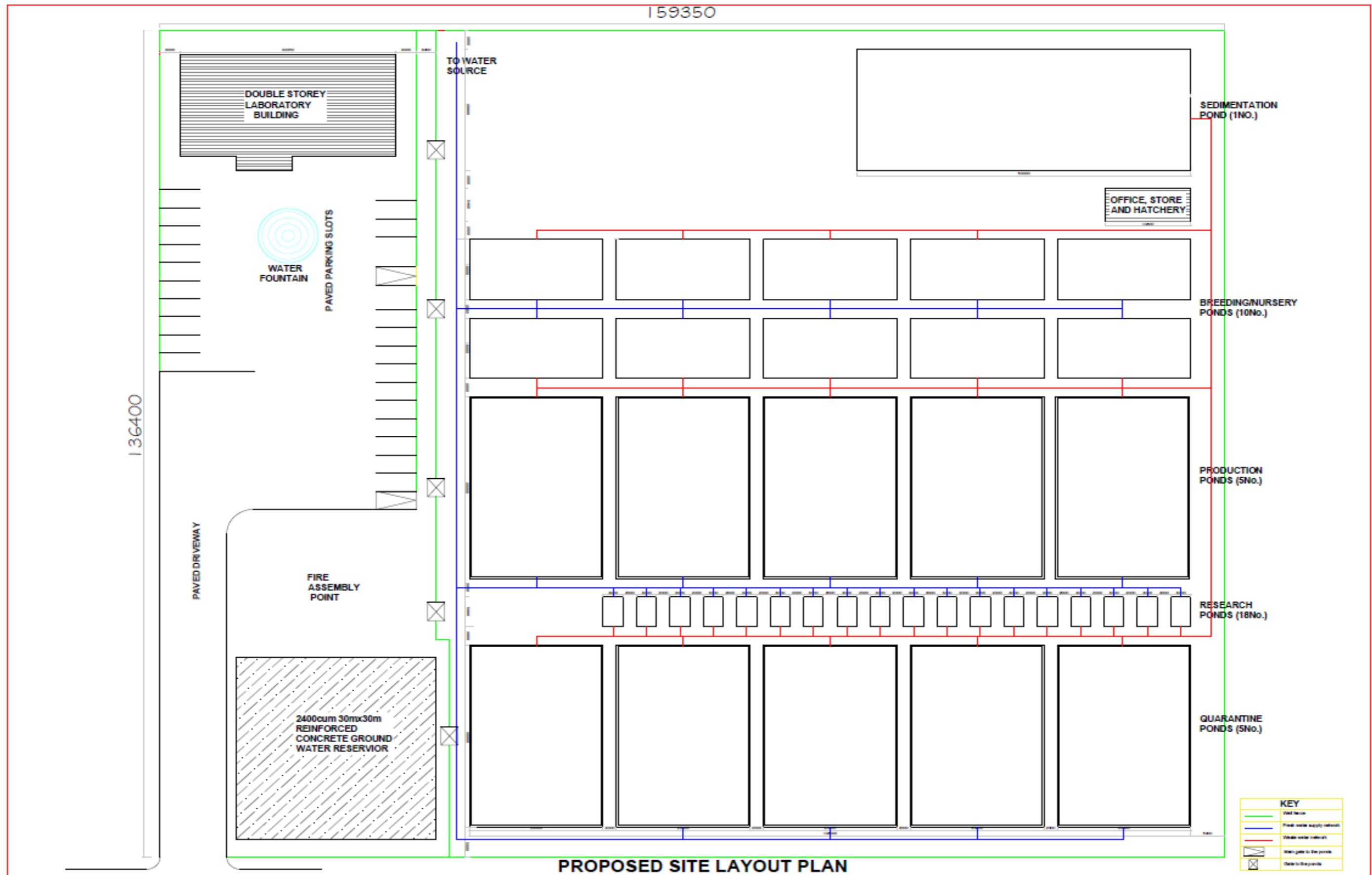


Figure 23: Proposed Layout Plan



Figure 24: Project Location Features

11.4 APPENDIX 4: WATER QUALITY RESULTS



SCHOOL OF ENGINEERING
 CIVIL & ENVIRONMENTAL ENGINEERING DEPARTMENT
 ENVIRONMENTAL ENGINEERING LABORATORY

P.O Box 32379, Lusaka

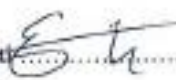

PHYSICAL/CHEMICAL EXAMINATION OF WATER

Attn : ZAED
 Sampled by : Client (KAIZEN)
 Sampling date : 02.11.2020
 Report date : 16.11.2020

Laboratory Results

Parameter	Kafue River @ Kasanka
pH	7.62
Turbidity (NTU)	5.69
Conductivity (µs/cm)	104
Total Dissolved Solids (mg/l)	52
Total Suspended Solids (mg/l)	<1.0
Total hardness (as mg CaCO ₃ /l)	52
Sulphides (mg/l)	<0.01
Dissolved Oxygen (as mg O ₂ /l)	4.2
Iron (mg/l)	0.23
Ammonia (as NH ₄ -N/mg/l)	<0.01
Sulphates (mg/l)	<0.01
Mercury (mg/l)	<0.001
Chemical Oxygen Demand (as mg O ₂ /l)	12
Total Nitrogen (mg/l)	0.08
Biochemical Oxygen Demand (as mg O ₂ /l)	5
Nitrites (as NO ₂ -N/mg/l)	<0.001
Nitrates (as NO ₃ -N/mg/l)	<0.01
Aluminium (mg/l)	<0.03
Total phosphates (mg/l)	<0.01
Cadmium (mg/l)	<0.0002
Magnesium (mg/l)	5.28
Calcium (mg/l)	12.0
Zinc (mg/l)	<0.005
Potassium (mg/l)	1.27
Arsenic (mg/l)	<0.0002
Sodium (mg/l)	3.96
Manganese (mg/l)	<0.01
Bacteriological Results	
Total coliforms (#/100ml)	96
Fecal coliforms (#/100ml)	22

Tests carried out in conformity with " Standard Methods for the Examination of water and Wastewater APHA, 1998".

Tested by: E. Mutati  Lab. Technician
 Checked & Approved by: Joshua Liyungu  Lab. Manager /Co-ordinator

