



THE REPUBLIC OF ZAMBIA
MINISTRY OF FISHERIES & LIVESTOCK



AFRICAN DEVELOPMENT BANK

ZAMBIA AQUACULTURE ENTERPRISE DEVELOPMENT PROJECT

KASEMPA SITE



ENVIRONMENTAL PROJECT BRIEF

IN RESPECT OF THE PROPOSED FISH PONDS AND INFRASTRUCTURE
DEVELOPMENT IN KASEMPA DISTRICT

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Prepared by








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EXECUTIVE SUMMARY

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 (MFL). The project is for 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 which include *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.

According to the Environmental Management Act N°. 12 of 2011 and in line with the Environmental Impact Assessment Regulations N°. 28 of 1997 Regulation 7(2), specifically requires that, a developer prepares and submits an EIA report before implementation for a project of this magnitude. It is with this background that the Ministry of Fisheries and Livestock through the Zambia Aquaculture Enterprise Development Project engaged Kaizen Consulting International in collaboration with JBN Consult and Planners Ltd to prepare an Environmental and Social Impact Statement (ESIS) to meet both Government of Republic of Zambia statutory permitting requirements as well as Africa Development Bank Safeguard Standards for the proposed aquaculture park and infrastructure project to be implemented in Kasempa District. The environmental and social impact assessment was meant assess, evaluate and propose mitigation measures for the potential negative impacts that may likely arise during the implementation of the project and to assist the Zambia Environmental Management Agency (ZEMA), to make a decision on the implementation of the project in Kasempa District.

Description of the Project

The proposed project involves setting up an Aquaculture Park in Kasempa District, North Western Province. This is 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. The aquaculture park is planned akin to the industrial park concept. Fish farms in an aquaculture park which will be pond-based are owned individually with a common management approach and leadership. The aquaculture park will concentrate fish farmers in one area making it easy to access utilities, credit and advisory services so as to take advantage of the economies of scale. Production from the aquaculture park will be planned according to market demands through phased out harvest throughout the year. The aquaculture park concept can work to transform small holder subsistence farmers into profitable aquaculture enterprises. In this system, traditional

practices such as integration of fish with other farming practices can be undertaken although the focus should be feed based aquaculture.

Oreochromis andersonii (3 spot bream) is the most commonly farmed species in the region. However, in other regions particularly, the Southern Region of Zambia and some parts of Lusaka the scenario is that Nile tilapia (*Oreochromis niloticus*) where the species colonized this is the species of choice. The Fisheries Act number 22 of 2011 does not allow translocation of species that are not endemic to other areas/ regions. One such species is *Oreochromis niloticus*. However, other Cichlid species such as *Oreochromis macrochir* (the green-headed bream) and *Coptodon rendalli* (the red-breasted bream) are also farmed. *Oreochromis andersonii* has demonstrated the highest growth rate among the farmed species, even though it does not grow to big sizes in comparison with *Oreochromis macrochir* (Green Headed Bream) is widely grown by small scale farmers.

The main project components related to the aquaculture park and related infrastructures will be set up at Kivuku Service Centre and will include:

- a. Construction of a hostel block to house 30 people. This should have 15 shared, (2 ablution blocks with toilets and showers by gender 2 male, 2 female) for the trainees and 5 single self-contained rooms (toilets and showers) for the trainers (the rooms should have fittings for storage), 1 class room to sit 40 people, toilets for the class room 2 female and 2 male (with hydro power, solar back up, water tank and borehole);
- b. Construction of a kitchen and dining room with fittings for storage to cater for 40 people with hydro power, solar back-up and water reticulation system;
- c. Construction of 2 medium and 3 low cost staff houses with hydropower, solar back up, sewer system and water reticulation;
- d. Construction of (1×3) Mini feed plant with (1×2) storerooms for feed with hydro power and solar back-up;
- e. Sinking of 1 borehole with overhead tanks, tank stands and pumps to service all components of the service centre;
- f. Construction of a complete sewer reticulation system to cater for all the buildings within the service centre. This includes the office block, ablution block, hostels and staff houses;
- g. Construction of a (1×3) Office block with hydropower, solar back up, sewer system and water reticulation;
- h. Construction of 10 parking slots;
- i. Construction of fencing at the service centre (wall fence to cover 2.5ha);
- j. Construction of the 1 poultry house (15m x 20m);
- k. Construction of 1 piggery unit (15m by 20m);
- l. Construction of an Indoor hatchery with hydropower, solar back up, sewer system and water reticulation;
- m. Rehabilitation of 6 earthen breeding ponds (20x30m);
- n. Construction of 8 semi concrete conditioning ponds (5 x10m);
- o. Construction of 8 nursery earthen ponds (10m x 20m);

- p. Construction of 1 earthen sedimentation pond (40m x 50m). All the ponds should be fitted with inlets, outlets, drainage pipes, overflow pipes and screens;
- q. Construction of the storm drain and an external drainage system (surrounding buildings);
- r. Construction of a fish bulking facility with cold chain facilities, smoking kiln and salting facilities, installed with hydro power, solar back up, water reticulation, waste disposal and drainage facilities;
- s. Construction of 2 input outlets, powered by hydroelectricity, solar back up with a water reticulation system;
- t. Construction of 1 weir at Shibende;
- u. Rehabilitation of 4 weirs, in the following areas; Lubofu, Mpungu, Nkenyauna, and Kabele;
- v. Assess the suitability of constructions of 200 (30m × 20m) earthen out grower ponds as follows; Lubofu 70, Mpungu 50, Nkenyauna 25, Shibende 25 and Kabele 30;
- w. Assess the suitability of construction of 5 earthen nurseries ponds in the following areas;
 - o Lubofu,
 - o Mpungu,
 - o Nkenyauna,
 - o Shibende and Kabele for growing fry into fingerlings in all cluster sites;
- x. Rehabilitation of furrows in the following cluster sites; Lubofu, Mpungu,;
- y. Nkenyauna, Shibende and Kabele, giving a total of 4km; and
- z. Construction of 1 cage fabrication workshops

Public infrastructure

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

Total Project Cost

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

Project Objectives

The sector goal is to contribute to economic growth as well as food and nutrition security in Zambia. The project development objective is 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.

Project Location -Kasempa District

The project area is located in Kasempa District. Kasempa district lies in Agro Ecological Zone III. The district borders Solwezi district to the Northwest, Mufumbwe to the Southwest, Kaoma district to the south, Mumbwa and Lufwanyama districts to the East. The district lies on Latitude 13⁰ 28' South of the Equator and Longitude 25⁰ 50' East of Greenwich. Kasempa district covers a landmass of 21,000km². The district lies in Agro Ecological Region III, which is a high rainfall area. The district lies 1,234m above sea level. The spatial extent of the Kivuku Service centre is about 2.5ha.

Project Alternatives

Under the alternatives, the following were considered:

No Project Option

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. It is noted that, much as the choice not to implement the project would avoid all the potential negative environmental and social impacts, the local populations will miss the poverty and food interventions planned in the project if implemented implying, poverty and food insecurity levels in the beneficiary areas would remain high.

Site location

The current project sites (*Kivuku, Mpungu, Lobofu, Nkenyauna, and Shibende*) experience multiple challenges such high levels of poverty, changes in agro-climatic conditions, poor soils, etc. The choice of the sites was based on scientific suitability studies undertaken and focused on parameters such as water, topography, land-use and drainage system. These areas need the interventions poverty and socio-economic status of the communities are low coupled with food insecurity.

Sources of water

Two options were evaluated – surface and groundwater and the project will utilise both options by proposing to draw water for use in the fish ponds from the perennial rivers near with the project area and drawing water from the borehole to be sunk at the site.

Technology of ponds and fish cages

The use of ponds for both fingerlings and fish production was considered as most feasible option based on assessments of the proposed sites. Cage fish farming was dropped considering the fact that, it requires large continuously flowing water with a good depth. The continuously flowing water is ideal for fish culture as it guarantees good and abundant dissolved oxygen supply and flushes away waste products and unconsumed feeds (the closest Kivuku stream is considerably very shallow and cannot support fish cages).

Green water disposal

Disposal of water on land would be an environmental nuisance while the option of draining the water into the nearby rivers after treatment makes economic and environmental sense as water would be saved.

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 3: 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 4: 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 5: 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

- a. Food and Agricultural Organisation (FAO) Code of Conduct for Responsible Fisheries 1995;
- b. The Protocol on Fisheries for the Southern African Development Community of 2001;
- c. African Convention on the Conservation of Nature and Natural Resources, 1968;
- d. Southern African Development Community Best Practices and Management;
- e. Convention on Wetlands of International Importance, especially as waterfowl habitat 1971;
- f. The Convention on Biological Diversity, 1992;
- g. United Nations Framework Convention on Climate Change, 1992; and
- h. 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. Kasempa Town Council;
- c. Water Resources Management Authority;
- d. Department of Fisheries (Kasempa District);
- e. Zambia Aquaculture Enterprise Development Project; and
- f. Ministry of Fisheries and Livestock.

Potential Environmental and Social Impacts

The key environmental concerns of the project have been identified from the scoping exercise which involved some field work, reviews of reports, informant interviews and public consultations. The main key environmental concerns in respect of the proposed project activities are as follows:

Positive Socio-economic Impacts

Potential positive socioeconomic impacts expected during different phases of the proposed project include the following:

- a. ***Create employment opportunities:*** The project has a number of components involving infrastructure developments works and such implementation of works will provide avenues for employment from which, the people will gain income for their households. Households living in clusters (*Mpungu, Lobofo, Nkenyauna, and Shibende*) will be able to gain employment in the project. Others will gain employment during operations of the facilities in the form of managers, skilled labourers as well as unskilled labourers;
- b. ***Contribute to attainment of sector fish production strategy:*** Aquaculture is seen by Government as a vital sub-sector to improve livelihoods, provide jobs and improve food and nutrition security for its people. In particular, demand for protein from fish for human consumption has been increasing due to a rapidly growing population (2.93% annual as of 2018), increasing levels of affluence, coupled with growing demand for protein for both livestock and fish feeds. It now recognized by the Government of the Republic Zambia that, the protein gap in its population and amongst the rural poor will be met through fish farming hence, pivotal role of this project in the economy of Zambia;

- c. ***Improved fish handling and processing environment:*** The project is to construct a fish bulking facility with cold chain facilities, smoking kiln and salting facilities all installed with hydro-power which is solar power backed. In addition, there are plans to put in place, water reticulation, waste disposal and drainage facilities all to be done in accordance with Good International Industry Practices (GIIP) for fish handling and processing facilities thereby guaranteeing access to competitive local and international fish market and better income GRZ;
- d. ***Potential source for supply of standard fingerlings:*** Through the project, it is planned to construct an Indoor Hatchery with hydropower, solar back up, sewer system and water reticulation and its operationalization will create improved supply of standard fingerlings for aquaculture development which will not only supply the project but some nearby farmers who will pick on fish-farming. In particular, supply of fish feed and fingerlings in the surrounding communities and target markets (Solwezi and Kalumbila) is envisaged too;
- e. ***Support out-grower ponds development:*** The project is to undertake assessment of the suitability of constructions of 200 earthen out-grower ponds in the areas of; Lubofu, Mpungu, Nkenyauna, Shibende and Kabele. This will serve to support the wider community involvement in the project as well as empower livelihoods in the vicinity of the project in keeping with AfDB Guidelines on Complementary Initiatives;
- f. ***Improved access to extension services:*** One of the challenges in aquaculture as well as wider agriculture is access to extension services to support production at farm based levels. This is a problem in that, farmers (including fish farmers) are scattered in the countryside in remote and had to reach areas with poor infrastructure especially rural access roads. Aquaculture Parks present a scenario where fish ponds as well as the farmers are in one location and hence, easy to access by extensionists;
- g. ***Improved training and Centre facilities:*** The project is to construct accommodation facilities for training of farmers and project staff on fish farming. The facilities will be constructed taking into account special gender and faith needs and practices in terms of wash rooms and accommodation. For instance, the Muslim faithful require special ablution facilities and such will be taken into account while developing these facilities. In addition, the project will also construct modest staff quarters which will enhance operations of the Centres;
- h. ***Development and transfer of technical skills to the beneficiary communities:*** The project will involve use and operations of equipment and technologies, which will also be undertaken up those likely to be employed in the project by skilled personnel mostly from within the communities thereby facilitating the transfer of technical skills in aquaculture and broader fish farming. Empowerment in technical and entrepreneurship skills to enhance viable fish farming investment among the fish farmers in Zambia is anticipated to be one of the benefits of ZAEDP;
- i. ***Improved sanitation and hygiene (community and domestic):*** ZAEDP has planned to put in place interventions dealing with sewer system and water reticulation which will enhance public health and sanitation in the Centre and the project. Issues of hygiene in fish handling are key as such, the fish production process will be hygienic and safe. The proposed project will equally provide solid waste collection skips in the Centre;
- j. ***Improved water supply:*** The plan to sink 1 borehole with overhead tanks, tank stands and pumps targeting serving all components of the service centre and is possible, those in the immediate settings will equally benefit from clean water supply much as this will likely be minimal at the beginning since the project is not fully-fledged water supply;

- k. ***Serve as a multi-model and integrated enterprise*** the plan to put in place, a poultry house and a piggery unit are purposefully meant to develop integrated entities in which, waste fish can formulate to feeds for poultry and piggery at the same time, waste from poultry and piggery can be turned to organic manure which can support horticulture in and around the Centre to supply vegetables to urban areas and within as well as fed to fish. Such a development can serve as a demonstration centre for training farmers, women and youth in entrepreneurship. s (15m x 20m);
- l. ***Provide market for maize:*** The feeds component will procure maize from local small-scale maize and soya farmers in Kasempa once the project is operational;
- m. ***Put in place, supporting functions for production:*** The development of the land-based Aquaculture Park requires auxiliary functions and activities to support production, facilitate operations and reduce the production costs of fish farmers by grouping their efforts. Under this project in this area, there will be investments in terms supportive infrastructures will improve fish production and general operational environment. For instance, ZAEDP will support the rehabilitation of feeder roads from the main road to the service centre in Kivuku and this will come along with multiplier effects in terms of service delivery amongst others;
- n. ***Provide model schemes for popularization of land-based aquaculture in Zambia:*** The project will provide a model for successful large-scale pond-based aquaculture as opposed to isolated individual farmers' initiatives throughout the country and is hoped, such a success will be taken up in other areas as well thereby leading to improved fish production in the communities and the country at large;
- o. ***Opportunity for involvement of women, youth and vulnerable groups in the fisheries sector:*** This project has deliberate affirmative actions with special focus on encouraging and supporting interested women entrepreneurs to invest in the aqua-parks and in the end contribute to gender equality and development as it is likely to:
- ❖ Embrace women's participation in decision-making and ensure that women benefit from the project along with men;
 - ❖ Generate opportunities for the empowerment of women through training in latest aquaculture technologies; and
 - ❖ Safeguard the rights and needs of vulnerable or marginalized populations, including women and youth.
- p. ***Induced developments in the area:*** Apart from Government providing the land for the Aquaculture Park, it is also expected to provide and main infrastructure like roads and electricity. The improved infrastructure will lead to induced development through availability of energy for agro-processing and better transportation which all are incentives for development of the area; and
- q. ***Improved security:*** there are plans under ZAEDP to construct a wall fence of 2ha around the Centre as well as well as electrification of the Centre which not only improves security in the Centre but also in the immediate surrounding areas.

Negative Environmental Impacts

The potential negative impacts associated with the project relate to the following:

Construction based impacts

- a. ***Loss of vegetation:*** The process of clearing the sites for construction of fish ponds infrastructure and other associated ponds operational facilities will likely lead to loss of vegetation cover over much of the project site when fully developed. Though it is noted that, the sites do not have

vegetation of conservation concern, the cumulative areas to be cleared will lead to medium negative impacts on vegetation to be mitigated through:

- i. Restricting vegetation clearance to those sections of the project required for constructing of the project infrastructure development;
 - ii. Replanting and full restoration of the vegetation on completion of the construction at the specific sites;
 - iii. Undertaking deliberate effort to plant trees in some areas of the project for various uses such as ornamental, multi-purpose trees, and fuel needs for the work force; and
 - iv. Collecting and stock-piling the cleared vegetation for locals to collect for domestic wood fuel energy needs. However, there should be no open burning of biomass as mode of its disposal.
- b. ***Land use challenges in the project catchment areas:*** Land-use activities in the catchment areas of the project can affect the quantity and quality of surface water in its system. It is suggested that, the project could put some resources to support “Source Protection Activities” with a focus on the protection and conservation of water sources and ecologically sensitive habitats in the vicinity of the project as well as creation of buffer zones at the water sources. These ensure sustainability of the project.
- c. ***Extraction sites and use of construction materials:*** Quantities of construction materials such as fill materials, sand, fill materials and rock will be required for the construction of the Aquaculture Parks infrastructures as such, areas of extraction of such materials will bring land degradation concerns. Such sites will be fully and satisfactorily restored once construction is completed;
- d. ***Management of cut to spoil materials:*** The construction of the ponds will lead to excavation of volumes of earth materials, which will need to be disposed-off in environmentally sustainable manner. Some of those materials will be assessed such that, what is re-usable shall be used in back-filling and compacting of the site areas. Consideration shall also be given to persons interested in the top soils extracted from the project for use in their farms. However, excess soil will be disposed-off to approved sites with guidance of both the Project Engineer and the Environment Officer Kasempa areas District and ZEMA;
- e. ***Issues of HIV/AIDS prevalence amongst fisher community:*** It is noted that, in Zambia as of 2018, an estimated 1 200 000 people were living with HIV and the percentage of people living with HIV among adults (15–49 years) was 11.3%. With this national rate and as part of the country’s HIV/AIDS multi-sectoral mainstreaming strategy, ZAEDP will mainstream HIV/AIDS control interventions into its plans and activities in terms of awareness and sensitization as well as distribution of condoms and VCT services to both the workers and adjacent communities;
- f. ***Storm water and water runoff impacts:*** Likely to arise from site works thereby loading water sources and the river with its sediment loads which affects water quality in the ponds. This is to be mitigated through ensuring the surface is cleared off loose soils and compaction of the site coupled with planting vegetation on the site at the end of project works.
- g. ***Issues of occupational health and safety of the workers:*** The occupational health and safety risks envisaged during this phase are likely to include; constructional accidents, injuries, fatigue, and associated injuries. Using appropriate PPEs, (e.g. insulated gloves and shoes, goggles and clothing to protect against excess heat), ensuring workers have rest days and having in place, a modestly stocked First Aid kit on the site alongside training workers on basics of First Aid skills amongst others.

- h. **Construction waste management:** Construction activities will likely generate solid wastes that will require to be disposed and such wastes include plastic containers, cement bags and other packaging materials; and metal offcuts, glass, and other unwanted materials. Ensure solid waste generated is regularly disposed appropriately at authorized dumping sites.

Operational phase-based impacts

- a. **Public health aspects in the project:** The project should put in place, facilities for its workers i.e. separate toilets for male and female workers as well as for those visiting the project. Such facilities should at least be 30m from a nearby water source with proper containment in case of any breakage or collapse. The facilities should be routinely cleaned and well labelled as per destined usage.
- b. **Fears of risks of fish diseases outbreaks:** Most African fish including Tilapia are reported to be less susceptible to disease attacks and most fish diseases tend to be related to environmental health and water quality aspects. Therefore, measures to address fish diseases will involve use of disease prevention strategies as the first line of defence against disease and it will include application of good fish production and handling husbandry as well as maintaining good water quality in all fish rearing units. It will also involve routine inspections of farm stocks to observe behaviour and early indications of health problems and stress. When therapeutic agents are to be used, it is important to ensure, manufacturer/veterinarian's instructions on their application are strictly followed.
- c. **Fears on the management and disposal of fish stale feeds:** On average, the shelf life of fish feeds is said to be 6 months and any stale feeds be disposed-off in accordance with applicable guide i.e. in pits dug 50m away from water source and after which, they should be fully back-filled and compacted.
- d. **Water pollution risks:** Fish feeds, hormones and other nutrients is feared by cross-section of stakeholders' likely lead to eutrophication and development of algal blooms leading to pollution of the water body. Feed is the primary but also costly input in aquaculture fish farming technologies, and techniques have been developed to avoid its wastage through having and using top/good quality floating feeds which remaining floating within the ponds enclosure and feeding fish based on established feeding response i.e. timing of feeding in which, maximum uptake of feeds occurs thereby ensuring no feed remains floating and polluting the waters.
- e. **Thefts, security risks and possible vandalism of project facilities and installations:** Theft was identified to be one of the major constraints partly because most of the ponds are constructed at distant sites from the homesteads making them easy target by thieves. In this case, the ponds under ZAEDP will be close and part of the Centre with perimeter fencing and security lighting which will offer adequate security against intrusion and theft;
- f. **Impact relating to prevalence of malaria and related diseases:** Malaria is among the top causes of mortality and morbidity in the country and Zambia is one of the only 13 countries to record an increase in malaria among 91 countries monitored by the World Health Organization in 2015¹. However, there was a 21% upsurge in malaria prevalence between 2010 and 2015. No doubt, the project areas in the District of Kasempa equally reported high malaria incidence implying, the project infrastructures such as fishponds and the reservoirs present a risk in terms of malaria prevalence. Therefore, the project will collaborate with some on-going malaria control interventions in the area to address issues of malaria in the project;

¹ Nawa, M., Hangoma, P., Morse, A.P. *et al.* Investigating the upsurge of malaria prevalence in Zambia between 2010 and 2015: a decomposition of determinants. *Malar J* **18**, 61 (2019). <https://doi.org/10.1186/s12936-019-2698-x>

- g. ***Post-harvest processing facility impacts:*** After harvest, the fish will be brought to its post-harvest processing facility. At the early stage of the Aquaculture Park development, the processing should only involve sorting to remove the deformed fish and excessively small fish, weighing and putting the fish on ice in crates. The handling facility be of standard type with appropriate facilities for handling, storage and disposal of unsuitable fish.
- h. ***Issues of predators in fishpond operations:*** predators can cause significant losses in farmed fish enterprises through mainly physical direct eating the fish, causing injuries and acting as intermediate hosts for parasites. Some of the common predators in fishponds include birds such as egrets, herons, storks, cormorants, ibises and kingfisher. Some of the measures to address predation in fish farming include:
- ❖ Controlling vegetation growth near the fishponds hence, denying predators opportunities hide and easily access ponds;
 - ❖ Having cover nets over the ponds which keeps away predator birds off the ponds;
 - ❖ Fishponds should be of a depth of at least 0.8-1.0m and the banks should be steep (design angle) to make it difficult for birds to wade through water;
 - ❖ Fertilize the ponds with manure, the algae generated reduces visibility for the birds (this should be through technical guidance to avoid algal blooms);
 - ❖ Immediate removal and burying any dead fish away from the ponds which stops predators from smelling fish in the ponds; and
 - ❖ Use of barbed and chain-link fence around ponds to keep off thieves and other predators like Otter Shrews and Monitor Lizards out of the ponds.
- i. ***Risks of potential exploitation of vulnerable groups (women, youth) in the enterprises:*** Unlike capture fisheries, which are dominated by men, aquaculture is generally a gender-neutral technology where women and children are generally responsible for pond management when ponds are part of integrated farming systems through activities involving collection of feed and fertilizer for ponds. However, much as these are gender inclusive, it is feared, vulnerable groups can be exploited in the ventures. Under ZAEDP, deliberate measures are planned to ensure effective and meaningful mainstreaming of gender into the project. Secondly, the project will work closely with lead gender sector agencies (Ministry of Gender and Kasempa Community Development Officers) to ensure women meaningfully get involved in the project.

Environmental and Social Management Plan

These potential negative environmental and social impacts were analysed and evaluated and appropriate mitigation measures developed to eliminate or reduce these impacts to acceptable levels. The institutional roles and responsibilities for each of these mitigation measures have been allocated to ensure accountability and their implementation. These mitigation measures are presented in the Environmental and Social Management Plans (ESMP). There are a number of key mitigation measures and actions needed to make this project environmentally sustainable among them include the following:

- a. Re-circulation technology can retain more than 80% of organic matter and recycle up to 90% of water. However, it can be too expensive for most aquaculture species and involves high energy use;
- b. Management will take into consideration careful aquaculture park design, good site selection and construction of 6 breeding ponds will minimize habitat impacts by avoiding delicate habitats and where disturbance is inevitable retaining as much vegetation as possible and replanting where

necessary. Construction of 1 sedimentation pond (40 x 50m) for discharge of waste water will enable control of pollution of water quality in Kivuku stream.

- c. Reduction of feed conversion factors by using better feeds, feeding detection systems, better training, and using more efficient farmed strains;
- d. Careful selection of individual sites and ensuring that the production is within the ecosystem carrying capacities;
- e. Having proper biosecurity frameworks in place, preventing diseases and avoiding the use of chemicals and other treatments;
- f. Institute appropriate monitoring and follow up.

Environmental Main monitoring and Monitoring Indicators

The Zambia Aquaculture Enterprise Development Project Implementation Unit will take a lead in environmental and social compliance monitoring of the project in collaboration with the Zambia Environmental Management Agency (ZEMA), Kasempa Town Council and its Fisheries Department, Water Resources Management Authority, Department of Fisheries (Kasempa District), and the Ministry of Fisheries and Livestock. Mechanisms for their enhanced operations are defined in the institutional mechanism. Some of the monitoring indicators will include:

- a. Presence and status of public health facilities on the site;
- b. Compliance of site project works with both ZEMA and contract provisions;
- c. Waste water handling measures in place and their operations;
- d. Measures for malaria and disease control in place through collaborative arrangements which could involve some existing health care providers operating in the areas of Kasempa;
- e. Number of sensitization and awareness meetings on HIV/AIDS, Gender mainstreaming, GBV and First Aid and emergency preparedness measures instituted in the project;
- f. Safety aspects in the project i.e. provision and use of PPEs for the workers;
- g. Safe fish health handling measures in place (handling shelters etc.);
- h. Project security measures instituted and their operations;
- i. Measures for addressing predation concerns in the project;
- j. Fish feeds quality and safe handling measures including storage in the project;
- k. Training on Emergency Response and Preparedness in the project; and
- l. Number of environmental and social safeguards trainings imparted to the fish farmers.

CONCLUSION

The following conclusions can be drawn from the project:

- a. While it is now recognized that, outputs in capture fisheries and small-scale aquaculture are increasingly stagnating, commercial aquaculture holds promising potential to help increase the availability and accessibility of fish in the country, especially for the rural poor in Zambia;
- b. It is also noted that, lately, fish is becoming significantly less accessible especially for the lower income populations when market prices are beyond their means and indications are that, the nutritional status of such people is worsening with alternate sources of animal proteins is declining;

- c. Based on the trends of population increase, annual fish demand is projected to be at least 40% above the current unsatisfactory fish consumption levels. In view of these, and in order to attain national self-sufficiency in fish protein requirements in Zambia, an important alternate source of fish production is increasingly recognized to be fish farming hence, importance of this project in socio-economic development of the country; and
- d. However, implementation of the proposed Project will likely trigger a number of environmental and social concerns which have been assessed in this study likely to be largely localized, of short-term nature, medium scale and can be addressed through implementation of the ESMP which is expected to ensure compliance and sustainability. Therefore, the proposed ZAED Project is recommended for consideration and approval.



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Zambia Aquaculture Enterprise
Development Project

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ACRONYMS

AfDB	African Development Bank
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
DHID	Department of Housing and Infrastructure Development
DISS	Department of Infrastructure and Support Services
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EMA	Environmental Management Agency
EMMP	Environmental Management and Monitoring Plan
EPF	Environmental Protection Fund
ERPP	Energy Response and Preparedness Plan
EPB	Environmental and Social Impact Assessment
ESIS	Environmental and Social Impact Statement
ESMP	Environmental and Social Management Plan
FGD	Focused Group Discussions
GIDD	Gender in Development Division
GMAs	Game Management Areas
GRZ	Government of the Republic of Zambia
IUCN	International Union for the Convention of Nature and Natural Resources
LDCs	Least Developed Countries
MCDSS	Ministry of Community Development and Social Services
MEWD	Ministry of Energy and Water Development
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
NAPA	National Adaptation Programme of Action
NHCC	National Heritage Conservation Commission
NISIR	National Institute of Scientific and Industrial Research
NPE	National Policy on Environment
NPs	National Parks
NWASCO	National Water and Sanitation Council
OHS	Occupational Health and Safety
PAPs	Project Affected Persons
RDC	Resident Development Committee
TORs	Terms of References
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank
WDC	Ward Development Committee
WiD	Women in Development
WRAP	Water Resources Action Programme
WRMA	Water Resources Management Act
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 in order 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 a number of 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, 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.

Most of the current aquaculture activities taking place in many places in Zambia have been using fish species collected from the wild and bred in captivity. They are reared in artificial ponds and of late in hatcheries for the production of fingerlings to be stocked in fishponds and other culturing facilities such as cages and raceways. However from time to time, it is important to cross the farmed strains with the wild ones so as to reduce inbreeding and to increase pond productivity. In the past *Oreochromis andersonii* (the three-spot bream) was the most commonly farmed species in Zambia, particularly in the commercial sector. Others were *Oreochromis macrochir*, *Coptodon rendalli*. In some parts of Zambia *Oreochromis niloticus* has been grown. This is limited only to those areas where it is already colonised through some accidental introductions. Its introduction in other areas is limited by the provisions of 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 in order 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 Zambia Aquaculture Enterprise Development Project through its Project Implementation Unit (PIU), in the areas of Chipeto (lake Kariba), Kasempa (Lake Bangweulu), Kasempa, Kafue, Kasempa and Kasempa 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-North Western, 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. Also, 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 intends to develop an aquaculture park and related public infrastructure in Kivuku area and in cluster areas (*Mpungu, Lobofu, Nkenyauna, and Shibende*) in Kasempa District. The project will involve developing a fully integrated aquaculture park. When fully implemented and operational the aquaculture park will have an indoor hatchery, 8 nursery ponds, 6 breeding ponds, 8 conditioning ponds, 1 bulky fish facility, 1 feed plant, 1 poultry, 1 piggery, hostel block, 2.5 ha boundary fence, water and sewer reticulation system, office block, 200 out grower ponds in cluster areas and other auxiliary facilities and installations. The project components will be implemented in four (4) phases that include

1.4 PROJECT PHASES

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 Kasempa Town Council.

1.4.2 CONSTRUCTION PHASE

This phase will include installation and construction of infrastructure such as accommodation, offices, hostels, fish feed plant, hatchery, piggery, poultry, toilets, breeding ponds, nursery ponds, fish bulking facility, out grower ponds, conditioning ponds, sedimentation ponds, boundary fence, water reticulation, sewer reticulation and rehabilitation of feeder roads from the main road to the Kivuku service center and cluster areas. This phase of the project will create a considerable number of job opportunities for locals.

1.4.3 OPERATION PHASE

Essentially, the operational phase is based on successful accomplishment of all the preceding phases and approval as provided for in the Fisheries Act Cap 22 of 2011. The foregoing activities set the stage for the operational phase by making use of the infrastructure developed during the continuing construction phase. The nature of operations will involve all aspects of training, production, stocking, and feeding, harvesting and post-harvest operations. When fully implemented and operational the project will have the capacity to produce 8.2 million fingerlings and an estimated 8,440 tonnes of annual harvest.

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 similar to the rate of project operations

1.5 PROJECT TEAM CONTEXT

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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)
Objective: To evaluate Contagious Bovine for Pleuro-Pneumonia ben-1 vaccine as well as evaluate the use of anti-micromicals to treat CBPP. Location: Country wide Start Date: 2013 End Date: 2018 Funding Agency: United Kingdom/Bill and Melinda Gates Foundation. Project Beneficiaries: Ministry of Fisheries and Livestock, Livestock farmer households afflicted by CBPP	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. Location: Serenje, Choongwe, Chitambo, Kasempa, Sinaziongwe and Kasempa Start Date: 2014 End Date: 2018 Funding Agency: African Development Bank (ADB) Project Beneficiaries: Small holder Farmers
Livestock Development and Animal Health Project. (LDAHP)	Livestock Infrastructure Support Project (LISP)
Objectives: To improve the productivity of key livestock production systems for both women and men targeted smallholder producers in identified areas. Location: Country wide Start Date: 2012 End Date: 2018	Objective: To improve smallholder livestock production, productivity, create market linkages and increase incomes of livestock farmers. Location: 9 Districts in North Western and Muchinga Provinces Start Date: 2013 End Date: 2018

Funding Agency: World Bank (IDA) Project Beneficiaries: Smallholder Livestock produce	Funding Agency: African Development Bank Project Beneficiaries: Smallholder livestock keeping households
Enhanced-Smallholder Livestock Investment Project (E – SLIP)	FMD Viral Disease Management Programme
Objective: Sustainably improve incomes of rural poor households in targeted provinces and districts. Improved production and productivity of key livestock systems of targeted female and male smallholder producers in all the provinces in Zambia Location: Country wide Start Date: 2015 End Date: 2021 Funding Agency: GRZ, IFAD, OFID AND BENEFCIARIES Project Beneficiaries: Smallholder livestock keeping farmers in Zambia	Objective: To sample a statistically significant sample of cattle herds in a Zambian region in order to characterize the FMD profile in the 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. Location: Country wide, but biased toward Livestock farmers affected with FMD (Foot and Mouth Disease) Start Date: 2015 End Date: 2019 Funding Agency: SIDA/ Bill and Melinda Gates.
Zambia Dairy Transformation Programme	Climate Resilient Livestock Management Project
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. Location: Countrywide in high potential zones. Start Date: 2017 End Date: 2022 Funding Agency: African Development Bank Project beneficiaries: Fish farmers and entrepreneurs of which 50% are women in high potential targeted regions/zones	Objective: To build climate resilient in the Livestock Infrastructure Support Project Location: 9 Districts in North Western and Muchinga Provinces Start Date: 2017 End Date: 2020 Funding Agent: African Development Bank Project Beneficiaries: Smallholder Livestock farmers.

1.8 TOTAL PROJECT COST/INVESTMENT

The total project cost is **USD 1.8 million** and is expected to 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.

1.11 PROJECT LOCATION

The project area is located in Kasempa District. Kasempa district lies in Agro Ecological Zone III. The district borders Solwezi district to the Northwest, Mufumbwe to the Southwest, Kaoma district to the south, Mumbwa and Lufwanyama districts to the East. The district lies on Latitude 130 28' South of the Equator and Longitude 250 50' East of Greenwich. Kasempa district covers a landmass of 21,000km². The district lies 1,234m above sea level. The spatial extent of the Kivuku Service centre is about 2.5ha. The site coordinates in World Geodetic System 1984 (WGS 84), coordinate system

Table 2: The site positions in World Geodetic System 1984 (wgs84), coordinate system

Point ID	Latitude	Longitude
Kivuku	-13.495714°	25.864978°
Mpungu	-13.616698°	26.080927°
Nkenyauna	-13.496190°	25.903756°
Lubofu	-13.584611°	26.125284°

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 3: 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 also 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 has been prepared before the construction works begin. The TORs, EIA and Scoping reports have been submitted to ZEMA for approval.

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 alongside an ESMP have been prepared for ZEMA approval before its implementation is undertaken.

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 will also govern the discharge of any wastewater that may be produced at any stage of the project. In this case, there will be effluent that will be discharged from the fish ponds and the processing facilities into the lake. In addition, domestic operations will generate wastewater.

Compliance: Regular monitoring of water effluents from the ponds will be undertaken before its discharge to the water bodies in the vicinity.

2.3.4 THE FISHERIES ACT, N^o. 22 OF 2011

The Fisheries Act provides for the development of commercial fishing, enforcement of fishing regulations and laws such as fish ban. The Act also cites and identifies aquaculture as a viable means of developing fisheries 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 both for capture and aquaculture, demanding EIA for all large scale fishing 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, a full EIA should be undertaken in accordance with the provisions of the EMA.

Compliance: ZAEDP has complied with this condition through the preparation and EPB Report before construction begins. The specifications of the Department of Fisheries will be complied with during the lifetime of the project.

2.3.5 THE URBAN AND REGIONAL PLANNING ACT, N^o. 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 Kasempa Town Council in consultation with the North Western 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, N^o. 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 Kasempa District and Kasempa 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 (STAUTORY 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.

2.3.9 THE FORESTS ACT, N^o. 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 Kasempa 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.

2.3.10 THE WATER RESOURCES MANAGEMENT ACT, N^O. 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.

Relevance: The project is to be located on the catchment of the greater R. Zambezi, a shared water body between Zambia and Zimbabwe.

Compliance: In line with section 60, Department of Fisheries shall ensure that the use of water in does not impact on the use of the water by other users of the water in Kivuku stream and Lufupa River the river. Further to this, Department of Fisheries shall comply with any condition, limitation, restriction or prohibition that WARMA may impose for the sustainable utilisation of the water in the rivers. Wastage of water along the water canal will not be allowed in line with section 66 which prohibits causing water to run to waste from any water works or abstracting water in excess of that granted under a permit. Furthermore, Department of Fisheries shall continuously monitor amounts of water abstracted and keep records of the amount of water discharged.

2.3.11 THE EMPLOYMENT ACT, N^O. 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.

2.3.12 THE WORKERS COMPENSATION ACT, N^O. 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.

2.3.13 THE OCCUPATIONAL HEALTH AND SAFETY ACT, N^o. 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.

2.3.14 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.

2.3.15 THE NATIONAL HERITAGE CONSERVATION COMMISSION (NHCC) ACT, N^o. 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.

2.3.16 THE ANIMAL HEALTH ACT N^o. 27 OF 2010

The Animal Health Act No. 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.

2.3.17 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.

2.3.18 ROADS AND TRAFFIC ACT N^o. 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.

2.3.19 THE NATIONAL PENSIONS SCHEME ACT N^o.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.

2.3.20 NATIONAL COUNCIL FOR CONSTRUCTION ACT N^o. 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.

2.3.21 THE STANDARDS ACT N^o. 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.

2.3.22 THE ZAMBIA WILDLIFE ACT N^o. 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.

2.4 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.

2.4.1 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.*

2.4.2 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.*

2.4.3 2.4.3 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*

2.4.4 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 dominance.

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.*

2.4.5 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*

2.4.6 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.*

2.4.7 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.*

2.4.8 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.*

2.4.9 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.*

2.5 INSTITUTIONAL FRAMEWORK

2.5.1 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 -Kasempa Town Council;
- d. Zambia Aquaculture Enterprise Development Project (PIU);
- e. Water Resources Management Agency (WARMA).

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

2.5.2 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 EPB report for the proposed Aquaculture Park and Public Infrastructure Project in Kasempa to ZEMA, requiring approval from the agency to undertake the proposed Project.

2.5.3 KASEMPA TOWN COUNCIL

Kasempa 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.

2.5.4 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.

2.5.5 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 through the Department of Fisheries. All Environmental concerns will be handled through by 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.

2.5.6 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

Kasempa district lies in Agro Ecological Zone III. Kasempa district lies in Agro Ecological Zone III. The district borders Solwezi district to the Northwest, Mufumbwe to the Southwest, Kaoma district to the south, Mumbwa and Lufwanyama districts to the East. The district lies on Latitude 13⁰ 28' South of the Equator and Longitude 25⁰ 50' East of Greenwich. Kasempa district covers a landmass of 21,000 km square. The district lies in Agro Ecological Region III, which is a high rainfall area. The district lies 1,234 m above sea level. The satellite images below show the visited project locations.

3.2 KIVUKU SITE LOCATION

The Kivuku site is 11km south-east of the Kasempa Town Council office. The main access route is through the D181 route, and the branching off to the east heading towards Mukinge Girls Secondary School. The site positional central coordinates are (Lat-13.495952, Lon 25.866503). The proposed project area is approximately 2.5ha.

Table 4: Kivuku site boundary coordinates

Point ID	Latitude	Longitude
1	-13.495714°	25.864978°
2	-13.494272°	25.866837°
3	-13.495510°	25.867600°
4	-13.496988°	25.865884°

3.2.1 LAND MARKS AND DEVELOPMENT SURROUNDING KIVUKU SITE

Table below displays the land marks, surrounding features, the distance and direction from of the project site.

Table 5: Kivuku site Land Marks

No.	Land marks	Distance from site	Direction
1	Mukinge Girls Secondary School	800	North-West
2	Lufupa River	600 m	West
3	Kivuku Health Centre	200m	South
4	Kivuku School	200m	South
5	Storage Facility – Brick Structure	In site	

PROPOSED KASEMPA DISTRICT AQUACULTURE PARK

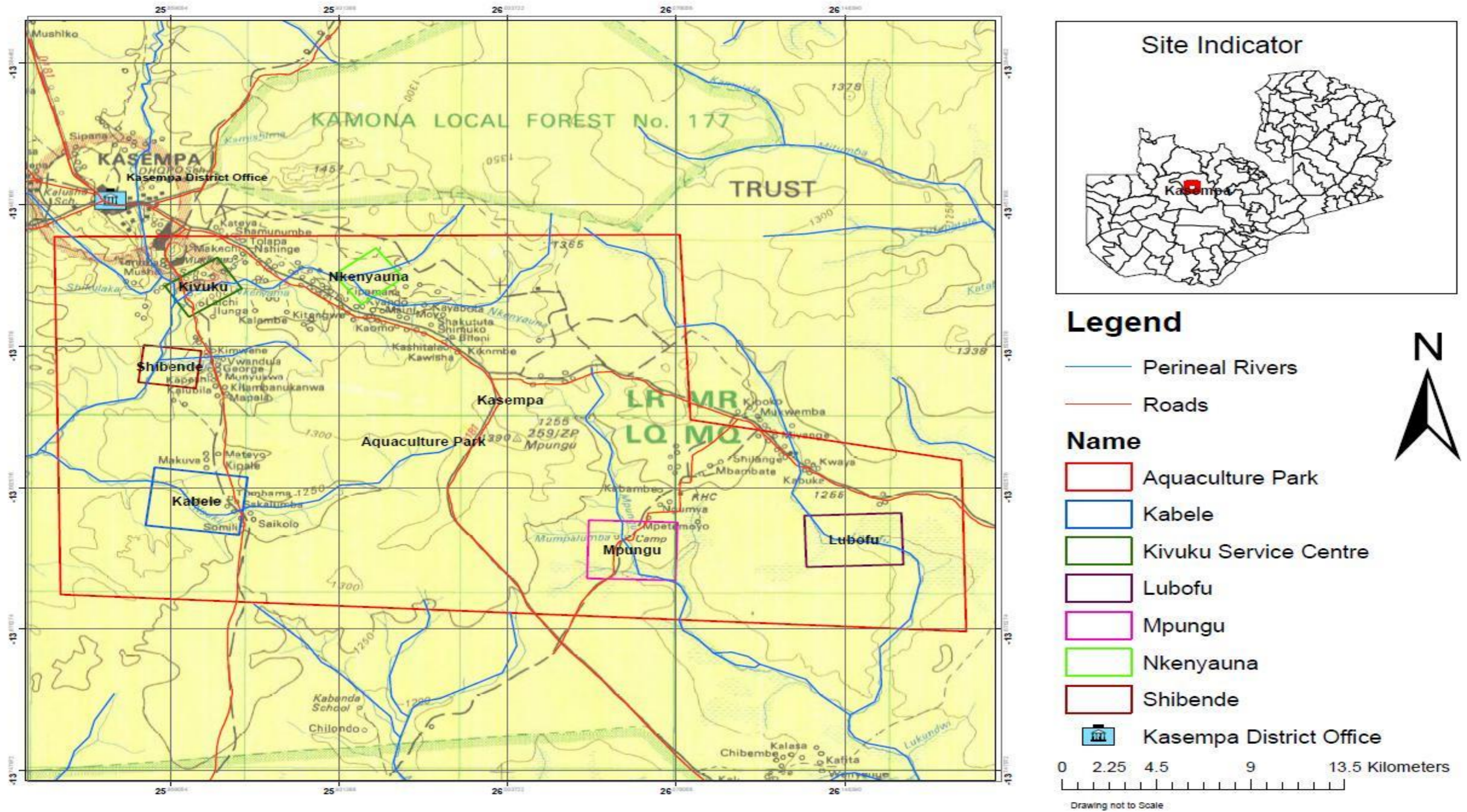


Figure 1: Kasempa Topographic Map



Figure 2: Kivuku Site Showing Boundary Points

3.3 MPUNGU SITE

The Mpungu site is 40km south-east of the Kasempa Town Council office. The main access route is through the D181 route, and the branching off to the eastern direction. The site positional central coordinates are (Lat-13.618231°, Lon 26.081839°). The proposed project area is approximately 7.5ha.

Table 6: Mpungu site b boundary positions in World Geodetic System 1984 (wgs84), coordinate system

Point ID	Latitude	Longitude
1	-13.616698°	26.080927°
2	-13.618433°	26.083799°
3	-13.621728°	26.082248°
4	-13.620206°	26.079339°

3.3.1 LAND MARKS AND SURROUNDING DEVELOPMENT

The table 7 displays the land marks, surrounding features, the distance and direction from of the project site.

Table 7: Land Marks and Development Surrounding Mpungu Cluster Site

No.	Land marks	Distance from site	Direction
1	Fish Ponds 12 Fish	Within the site	
2	Mpungu Stream	50 m	East
3	Mpungu Village	500m	North-East
5	Nkenyauna Village	1000m	North-West
6	Storage Facility – Brick Structure	Within Site	

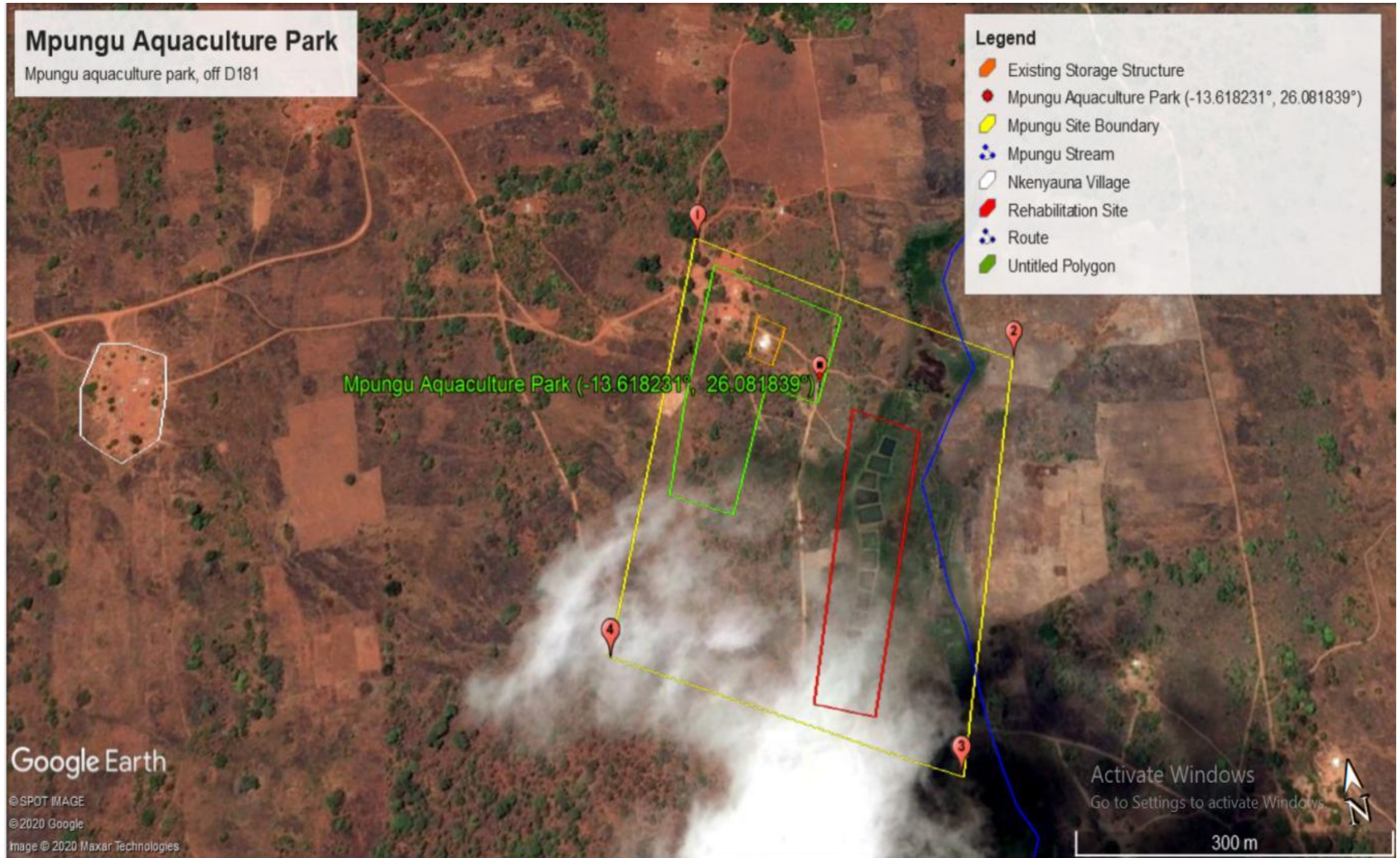


Figure 3: Mpungu Site Showing Boundary Points

3.4 NATURE OF THE PROJECT

ZAEDP activities will be implemented in Kivuku and in cluster areas of *Mpungu, Lobofu, Nkenyauna, and Shibende* of Kasempa District will involve developing a fully integrated aquaculture park.

3.4.1 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
- m. Fuel

3.4.2 PRODUCTS AND BY-PRODUCTS

3.4.2.1 CONSTRUCTION PHASE

No products will be generated at this stage. However, the construction activities will give rise to a number of 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

3.4.2.2 OPERATIONAL PHASE

The major product sought by the project is the fish. The fish will be frozen and transported to selling points. By-products from the processing of fish such as heads, scales, bones and gut will be converted into fertilizers. Fat and guts will be used as a valuable product for use in the production of animal feed. Therefore, no fish wastes from processing will be released into the surrounding ecosystem. The fish wastes, including mortalities, will be processed into fish meal and fish oil for use as feed for livestock such as poultry, pigs and farmed fish. Wastes will not be discharged into the environment. Waste water will be treated through a rendering plant and sedimentation pond to produce water which is within acceptable physical, biological and chemical levels for release into the environmental.

3.4.2.3 POST CLOSURE PHASE

The dismantled fish ponds and associated infrastructure will be the main waste generated during the decommissioning and closure phase. Selling of recoverable items as well as recycling and reuse of these items will be explored instead of outright disposal.

3.5 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:

3.5.1 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 Kasempa Town Council.

3.5.2 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.

3.5.2.1 DETAILED SCOPE OF WORKS DURING CONSTRUCTION PHASE

Kivuku Service center whose approximate land allocation is as shown in figure 26 (site layout) has an extent of 159.35m by 136.40m as available land for various components will have the following developments.

- a. Construction of a hostel block to house 30 people. This should have 15 shared, (2 ablution blocks with toilets and showers by gender 2 male, 2 female) for the trainees and 5 single self-contained rooms (toilets and showers) for the trainers (the rooms should have fittings for storage), 1 class room to sit 40 people, toilets for the class room 2 female and 2 males (with hydro power, solar back up, water tank and borehole).
- b. Construction of a kitchen and dining room with fittings for storage to cater for 40 people with hydro power, solar back-up and water reticulation system

- c. Construction of 2 medium and 3 low cost staff houses with hydropower, solar back up, sewer system and water reticulation.
- d. Construction of (1×3) Mini feed plant with (1×2) storerooms for feed with hydro power and solar back-up.
- e. Sinking of 1 borehole with overhead tanks, tank stands and pumps to service all components of the service center.
- f. Construction of a complete sewer reticulation system to cater for all the buildings within the service center. This includes the office block, ablution block, hostels and staff houses
- g. Construction of a (1×3) Office block with hydropower, solar back up, sewer system and water reticulation.
- h. Construction of 10 parking slots.
- i. Construction of fencing at the service center (wall fence to cover 2.5ha).
- j. Construction of the 1 poultry house (15m x 20m)
- k. Construction of 1 piggery unit (15m by 20m).
- l. Construction of an Indoor hatchery with hydropower, solar back up, sewer system and water reticulation.
- m. Rehabilitation of 6 earthen breeding ponds (20m x 30m)
- n. Construction of 8 semi concrete conditioning ponds (5m x 10m)
- o. Construction of 8 nursery earthen ponds (10m x 20m),
- p. Construction of 1 earthen sedimentation pond (40m x 50m). All the ponds should be fitted with inlets, outlets, drainage pipes, overflow pipes and screens.
- q. Construction of the storm drain and an external drainage system (surrounding buildings).
- r. Construction of a fish bulking facility with cold chain facilities, smoking kiln and salting facilities, installed with hydro power, solar back up, water reticulation, waste disposal and drainage facilities.
- s. Construction of 2 input outlets, powered by hydroelectricity, solar back up with a water reticulation system.
- t. Construction of 1 weir at Shibende
- u. Rehabilitation of 4 weirs, in the following areas; Lubofu, Mpungu, Nkenyauna, and Kabele.
- v. Assess the suitability of constructions of 200 (30m × 20m) earthen out grower ponds as follows; Lubofu 70, Mpungu 50, Nkenyauna 25, Shibende 25 and Kabele 30.
- w. Assess the suitability of construction of 5 earthen nurseries ponds in the following areas; Lubofu, Mpungu, Nkenyauna, Shibende and Kabele for growing fry into fingerlings in all cluster sites.
- x. Rehabilitation of furrows in the following cluster sites; Lubofu, Mpungu, Nkenyauna, Shibende and Kabele, giving a total of 4 Km.
- y. Construction of 1 cage fabrication workshop

3.5.2.2 PUBLIC INFRASTRUCTURE

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

3.5.3 OPERATION PHASE

The following activities will take place during the operational phase of the project:

3.5.3.1 PRODUCTION OF FINGERLINGS

ZAEDP (PIU) proposes to construct an indoor incubation facility and 6 semi-concrete breeding ponds of 375m² to grow about 6 million fingerlings. The fingerlings will then be transferred to nursery ponds

for stabilization and the primary stages of growth. The project also proposes to construct 4 semi concrete nursery ponds of 375m² where fish the nurslings will held for up to 2 to 3 months. Once the correct length and size is reached (2-5) cm in length or (3-5gms) in weight, the fingerlings will be transferred to out grower ponds where they will remain until harvest.

3.5.3.2 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. The stocking density was calculated by multiplying the length and width to find the surface area of water in square meters. The pond size is 375 m² and multiplied and will therefore be multiplied at the time of stocking by 5 fingerlings for every square meter.

3.5.3.3 CARRYING CAPACITY.

Carrying capacity is maximum number of ponds the environment can carry and sustain, considering its geography or physical features. The Aquaculture Park will have 200 (30m × 20m) earthen out grower ponds as follows; Lubofu 70, Mpungu 50, Nkenyauna 25, Shibende 25 and Kabele 30. There will also be constructed 5 earthen nurseries ponds in the following areas; Lubofu, Mpungu, Nkenyauna, Shibende and Kabele for growing fry into fingerlings in all cluster sites.

3.5.3.4 FISH SPECIES

Fish species occurring in the area are those found in the local streams and rivers such as the Lunga, A comprehensive inventory of the species is yet to be done by the Department Fisheries. Common species such as *Oreochromis macrochir*, *Oreochromis andersonii*, *Coptodon rendalli* are all common in the area. Subsistence fishing takes place in the area most focuses the capture of the named species and the fish consumed within the District. For smallholder farmers, the types of fish stocked currently being used include *Oreochromis macrochir*, *Oreochromis. andersonii*, and *Coptodon rendalli*. No exotic species are allowed in compliance to the provisions of the Fisheries Act Number 22 of 2011.

For aquaculture purposes, farmers of all sizes are legally permitted to farm Nile tilapia (*Oreochromis niloticus*) in certain areas of the country and only subject to the provisions of the Fisheries Act No. 22 of 2011. Farmers also cultivate local species such as the three-spotted bream (*Oreochromis andersonii*), the greenhead bream (*Oreochromis macrochir*), the redbreast bream (*Coptodon rendalli*), with the majority growing these species because they are located in areas where the cultivation of *Oreochromis niloticus* is banned or because they are the only type of seed available, usually from government hatcheries. Where the species is allowed because it is already present in those areas, Nile Tilapia remains the number one fish culture species of choice in Zambia for land based aquaculture.

3.5.3.5 SEX REVERSAL

Sex reversal of newly hatched tilapia generally is accomplished via oral administration of methyl testosterone (MT), a hormone that is mixed with the feed and fed to the fry for the first 21 active days of life while the fry is still sexually labile. Sex Reversal for male fish grows faster and bigger than females. This results in approximately 90-95% dominance of males. The FAO (2006a, Aquaculture production statistics 1997-2006, FAO 2006, Fisheries and Aquaculture Department) accepts the use of this hormone conditional on observing best practices in aquaculture.

3.5.3.6 FEEDING

The feed for the fish needed for the project will be obtained from the feed manufacturing plant to be installed at the facility. The nutrient composition of fish feeds comprises phosphorous and nitrogen as the main nutrients. The main nutrient elements of the fish feed are:

Table 8: Fish feed composition

Raw Materials	Composition	Nutrient	Composition
Maize	9.0% - 12%	Phosphorous	0.8% – 1.1%
Soya Beans	40% - 55%	Nitrogen	3.5% - 4.8%
Wheat	5% - 10%	Calcium	0.3% - 1.0%
Fish meal	2% - 6%		

National Aquaculture Research and Development, Brochure 2019

3.5.3.7 FISH HARVESTING

From the production of fry to fully grown fish, it will take approximately 8 months to produce fish for consumption. Fish will be harvested from the ponds and delivered to the processing facility to be installed at project site. At full production, approximately 8,000 tonnes will be produced annually.

3.5.3.8 PROCESSING

During harvest the fish will be taken to the processing plant on land where they will be checked for size, weight and quality, cleaned, and then packed on ice for delivery. The facility will be equipped with a fish bulking facility with cold chain facilities, smoking kiln and salting facilities. At full production the processing plant will employ a total of approximately 50 staff. Works at the processing plant will consist of maintaining the highest hygiene standards. Food grade flooring and drainage systems will enable constant washing and sanitizing of the working areas. Personal protective clothing will be provided to all employees on a daily basis, with changing facilities and laundry facilities on site. Fish will thereafter be transported to the markets mainly Solwezi and the Copper belt using refrigerated trucks.

3.5.3.9 DECOMMISSION AND CLOSURE

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:

- a. Promote alternative economic activities in the area that are sustainable in the future;
- b. Ensure the safety of surrounding communities through public consultation and the erection of warning signs;
- c. 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
- d. Prevent potential significant adverse effects on adjacent environs.

Where possible, Department of Fisheries will ensure that progressive rehabilitation is undertaken so that the rate of rehabilitation is similar to the rate of project operations. The following closure criteria

summarises the fundamental criteria for closure processes, from initial planning through to actual implementation and will be considered while designing and closing the site:

Table 9: Fundamental criteria for closure

Issue	Closure Objectives
Physical stability	All remaining anthropogenic structures are physically stable
Chemical stability	The biological environment is restored to a natural, balanced ecosystem typical of the area, or is left in such a state so as to encourage and enable the natural rehabilitation and/or reintroduction of a biologically diverse, stable environment.
	Closure aims at preventing physical or chemical pollutants from entering and subsequently degrading the downstream environment – including surface and ground waters.
Geographical and climatic influences	Closure is appropriate to the demands and specifications of the location of the site in terms of climatic (e.g. rainfall, storm events, seasonal extremes) and geographic factors (e.g. proximity to human habitations, topography, accessibility of the mine)
Local sensitivities and opportunities	Closure optimises the opportunities for restoring the land and the upgrade of the land use is considered whenever appropriate and/or economically feasible.
Land use	Rehabilitation is such that the ultimate land use is optimised and is compatible with the surrounding area and the requirements of the community.
Funds for closure	Adequate and appropriate readily available funds need to be available to ensure the implementation of the closure plan.
Socio-economic considerations	Consideration will be taken of opportunities to communities whose livelihoods may depend on the employment and economic fallout from project activities. Adequate measures made to ensure that the socio-economic implications of closure are maximised.

4 PROJECT ALTERNATIVES

4.1 IDENTIFICATION AND ANALYSIS OF PROJECT ALTERNATIVES

4.1.1 NO PROJECT OPTIONS

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. It is noted that, much as the choice not to implement the project would avoid all the potential negative environmental and social impacts, the local populations will miss the poverty and food interventions planned in the project if implemented implying, poverty and food insecurity levels in the beneficiary areas would remain high.

4.1.2 TECHNOLOGY OF PONDS VS CAGES

The use of ponds for both fingerlings and fish production was considered as most feasible option based on assessments of the proposed sites. Cage fish farming was dropped considering the fact that, it requires large continuously flowing water with a good depth. The continuously flowing water is ideal for fish culture as it guarantees good and abundant dissolved oxygen supply and flushes away waste products and unconsumed feeds (the closet Kivuku stream is considerably very shallow and cannot support fish cages).

4.1.3 SITE ALTERNATIVES

The current project sites (*Kivuku, Mpungu, Lobofu, and Nkenyauna*) experience multiple challenges such high levels of poverty, changes in agro-climatic conditions, poor soils, etc. The choice of the sites was based on scientific suitability studies undertaken and focused on parameters such as water, topography, land use and drainage system. These areas need the interventions poverty and socio-economic status of the communities are low coupled with food insecurity.

4.1.4 WATER SUPPLY ALTERNATIVES

Two options were evaluated – surface water and groundwater abstraction. The project will utilise both options by proposing to draw water from the Kivuku stream near the project area and drawing water from the borehole to be sunk at the site with overhead tanks, tank stands and pumps to service all components of the service center. From the hydrogeology baseline study conducted during site assessment, the project area has high ground water potential. The service park in Kivuku will have a modern water reticulation system that will be installed at the facility to ensure smooth running because when the project is fully implemented will demand huge amounts of water.

4.1.5 SEWAGE MANAGEMENT ALTERNATIVES

Only one alternative was considered for sewage management:

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. The project service center in Kivuku will have a complete sewer reticulation system to cater for all the buildings within the service center. This includes the office block, ablution block, hostels and staff houses.

4.1.6 TECHNOLOGY ALTERNATIVES

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

4.1.7 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.

The developer was looking for a design that would be eco-friendly and that would optimize the land area available and also take into account the existing vegetation. The current plan has optimized the land area available and takes into account the existing topography, hydrology systems, and vegetated areas. The construction methodologies and materials will be that of earth, concrete and brick work similar to 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 a number of physical structures and infrastructure.

4.1.8 POWER SUPPLY ALTERNATIVES

The alternatives for power supply are either to connect to hydropower power supply or set up a solar power plant to act as backup in case of power outages. Both options will be used.

5 BASELINE ENVIRONMENTAL AND SOCIAL-ECONOMIC SETTINGS

5.1 PHYSICAL ENVIRONMENTAL CONDITIONS

5.1.1 CLIMATE

Climate data obtained from the Solwezi Meteorological Station indicates the region has a monthly mean temperature of 27.5°C, monthly mean rainfall of 107.7mm, Monthly mean evaporation 6.3mm, monthly mean wind speed of 2.8m/s and monthly average relative humidity of 63.3%. The region has distinct dry (May to October) and wet (November-April) seasons. Rainfall mainly occurs in heavy thunderstorms producing precipitation events of 20-40mm. Daily rainfall data review from 2000-2009 from the Solwezi Meteorological Department indicates that the average total annual rainfall is 1320mm with the lowest recently recorded annual rainfall being 995mm.

5.1.2 TOPOGRAPHY

The physio geographic features of Kasempa district are very diverse, varying from hilly to flat terrain. The topography of the focus area reflects the relative stability and resistance to erosion of the various underlying lithologies. The landscape east of the project site comprises a series of low but prominent residual hill (Mukinge) on the feldspathic quartzites of the Basement Complex at altitudes of between 1,300m. Proceeding westwards towards the Busanga plain the elevation reduces further through more uniform country from approximately 1,300m to 1,250m on the Lufupa River. This landscape is dissected by several seasonal and mainly ephemeral streamlines (the Shibende and Nkenyauna Streams). Mukinge Hill, a Karroo Formation remnant horst rises to 1,300m above sea. The short grass floodplain then slopes gently southwest wards to approximately 980m at the Busanga plain. The Busanga plain retains open water most part of the year and its northern and western margins include small papyrus swamp. This terrain extends southwards to the Kafue River.

5.1.3 DRAINAGE

The proposed project sites in Kivuku and cluster areas are endowed with a number of rivers and streams that are perennial and seasonal in nature. The most predominant are the Lufupa, Lunga and Mpungu Rivers. The Lufupa and Lunga rivers and their tributaries drain the sites and flow south to join the Kafue River. Others flow west to join Kabompo River that finds its way to the Zambezi River. The watershed between these two systems is a major divide between the Zambezi and Kafue rivers. The Province's surface water is drained by the dendritic pattern of Kabompo River and its tributaries into the R. Zambezi.

5.1.4 SOIL

The soils around the project site in Kasempa 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 AND 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 project use provided use.

5.1.6 WATER RESOURCES: HYDROLOGY

Kasempa district is endowed with a number of rivers and streams. The two main river systems are Lufupa and Lunga and their tributaries. The Kafue River forms the boundary between Kasempa and Mumbwa districts and runs largely through the Kafue National Park. Kivuku is located near the Lufupa River about 200m away.

Kivuku Service Park is proposed at a site whose water resource is available within the catchment whose area is 16.654km². Considering the abundant rainfall received in North Western Province with the reference station being Solwezi which receives on average 995mm of annual rainfall, an annual runoff of about 2,422,733.46m³ is estimated based on the runoff coefficient of 14.7% (JICA) for the Kafue river catchment. The runoff coefficient is a dimensionless factor that is used to convert the rainfall amounts to runoff or equivalent flows in the rivers. This amount of runoff or surface water which is the available water in the river/s guarantees water security for the project.

Mpungu site is proposed at a site whose water resource is available within the catchment whose area is 6.676km². This is shown in figure 2. Considering the abundant rainfall received in North Western Province with the reference station being Solwezi which receives on average 995mm of annual rainfall, an annual runoff or surface water available of about 976,465.14m³ is estimated based on the runoff coefficient of 14.7% (JICA) for the Kafue river catchment.

5.1.7 WATER QUALITY SURVEYS

A spot check was done on the water quality for the sites at Mpungu (Mpungu Stream) and Kivuku (Lufupa River). The results as obtained from the University of Zambia School Of Engineering Civil & Environmental Laboratory are shown in Figure 4: Water Quality Test. The results indicated the parameters were within the ZABS guide lines. Considering these sites are in areas that could accommodate other activities such as farming and other land use, it is proposed that a continuous and robust water quality monitoring system should be put in place both at Kivuku Service Centre and in all cluster sites.

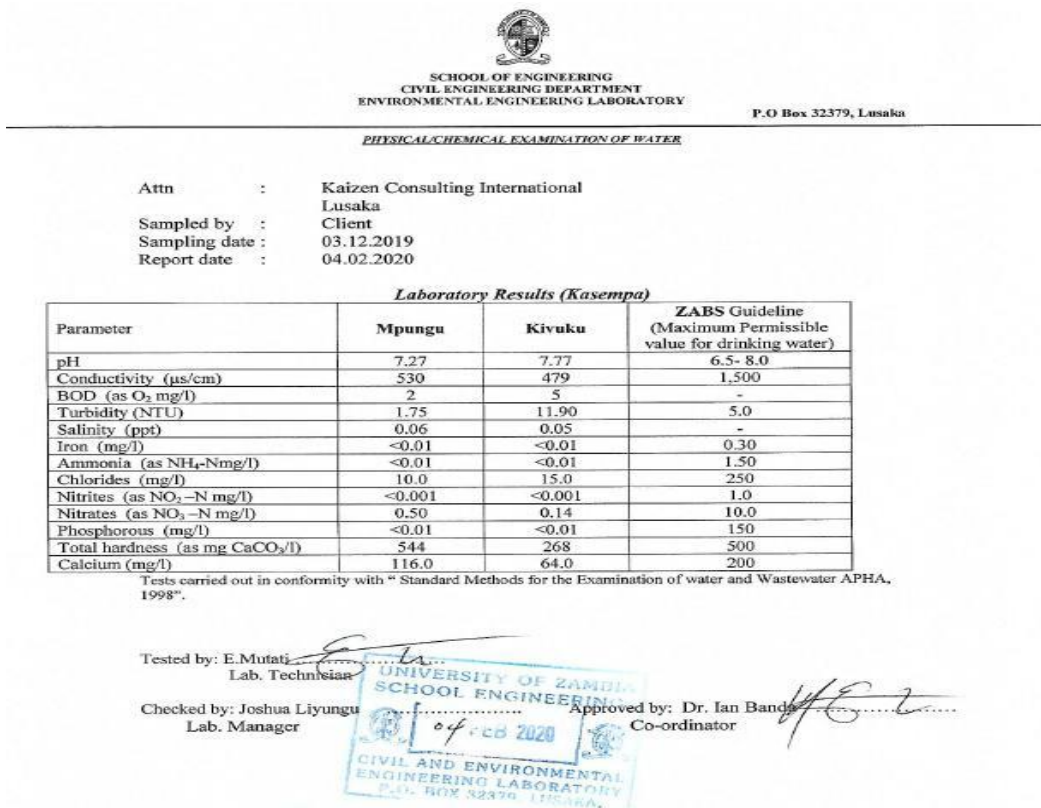


Figure 4: Water Quality Test

5.1.8 AIR QUALITY

The ambient air in the project area is good in terms of quality since the area is neither in an environment that would compromise its quality. Dust from unpaved roads and uncontrolled fires at times cause occasional smoke but it is insignificant to create pollution. The Department of Fisheries will not allow burning on its property. Dust particles due to construction activities will be minimized through sprinkling water on gravel roads.

Generally, Kasempa district has some mining activities which affect the air quality. Grassland and forest fires, charcoal burning and shifting cultivation practices during the dry season generate smoke and dust. This air pollution hangs over the area and forms a distinctive haze. The haze layer is visible from the air and worst during the coolest months (June and July) when temperature inversions tend to trap the smoke near ground level. The haze lasts until the arrival of the rains in November. Local air quality deterioration is also associated with village domestic fires. During construction works dust and exhaust emissions will be a potential impact due to construction activities. This will be the main source of poor air quality during construction.

Table 10: Air Quality Measurements in Kasempa

Location	TSP ² (µg/m ³)	PM ₁₀ ³ (µg/m ³)
Kivuku Site		
Point 1	22.4	9.2
Point 2	26.5	11.4
Point 3	27.2	9.8
Mpungu Site		
Point 1	367	11.9
Point 2	24.4	8.9
Point 3	26.1	9.3

Source: Kaizen Field Study.

Table 11: Zambian Guidelines 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 hour	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

² TSP = Total Suspended Particles, particles with diameter less than 45 micrometres(µm)

³ PM₁₀ = Respirable Suspended Particulate Matter, particles with less than 10 micrometres(µm)

Dust fall	30 days	7.5 tonnes/km ²
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Source: Regulation 5, 6 and 7 (1) of The Environmental Management (Licensing) Regulations, No. 112 of 2013

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

5.1.9 NOISE QUALITY

Noise in the district is mainly from vehicles passing in nearby gravel roads. Noise disturbance during the project implementation will increase from operation of the equipment during feeder roads rehabilitation, excavations works and the usual traffic on the access roads. However, this is insignificant as vegetation cover within the project area act as noise absorber.

Table 12: Noise Measurements

Location	Measurement in (dBA)
Kivuku Site	
Point 1	38.8
Point 2	63.1
Point 3	60.9
Mpungu Site	
Point 1	57.2
Point 2	49.1
Point 3	57.1

The range of noise measurements from the sampling points was from an average of 48.1 dB in Kivuku to 36.2 dB in Mpungu area. Generally, the Noise level in the project area of influence is relatively low. The low noise level is attributed to nature of the project area as it located in a rural part of the district designated as a farming area.

5.2 BIOLOGICAL ENVIRONMENT

5.2.1 FLORA

The vegetation type in the project area is predominantly wet Miombo woodland of Zambezian origin (88% of surface area). The natural Miombo woodland is characterised by a two-stage vegetation cover with a 15 to 12 m high open or semi-open canopy. The most common tree species are *Brachystegia*, *Isobertina*, *Julbernardia* and the genus *MarquEPB*. The dominant species is *MarquEPB* *marcrourea* (Muvuka). This tree's dominance is due to its resistance to fire. *M. marcrourea* is well established in terms of number of stems per unit area, size classes, diameter and height, and forms the major part of the canopy structure. Other tree species found in the Miombo woodland include *Pericopsis angolensis* (Mubanga), *Combretum molle* (muhuma), *Strychnos cocculoides* (katoña), *Azelia quanzensis* (mwala), *Erythrophleum africanum* (mukoso), *Lonchocarpus capassa* (kabosha), *Uapaca kirkiana* (musuku), *Anisophlea bohemii* (mufuñu), and *Diploryncus condylocarpo* (mudi). The Miombo under-storey vegetation is a dense cover of indigenous grasses and shrubs. Common shrubs include *Securidaca longipendiculata* (mutate), several *Rhus* species, *Ochna pulchra* (museñu) and *Harugana madagascariensis* (Katunya). Rare or endangered species are not found within and around the proposed project area.

5.2.2 FAUNA

Field survey of animal species (aquatic and terrestrial)

Table 13: Common fauna both aquatic and terrestrial species in the project area

Amphibians : Scientific Name		Common Name
1	<i>Rana occipitalis</i>	Giant swamp frog
2	<i>Breviceps poweri</i>	Rain frog
3	<i>Bufo lemairri</i>	Yellow toad
4	<i>Bufo regularis</i>	Camouflage toad
Reptiles		
	Scientific Name	Common Name
1	<i>Dendroaspis polyleppsis</i>	Black Mamba
2	<i>Bitis gabonica</i>	Gabon Viper
3	<i>Bitis arietans</i>	Puff adder
4	<i>Naja naja</i>	Common Cobra
6	<i>Python sebae</i>	Python
7	<i>Geochelone species</i>	Tortoise (various)
8	<i>gracilis</i>	Blind Snake
9	<i>Naja nigricollis</i>	Spitting Cobra
10	<i>Varanus niloticus</i>	Water Monitor
Fish (common fish found in the area)		
	Scientific Name	Common Name
1	<i>Claria spp</i>	Babble Fish
2	<i>Oreochromis spp</i>	Bream
3	<i>Serranochromis spp</i>	Yellow Berry Bream
Insects		
1	Scientific Name	Common Name
2	<i>Apis mellifera</i>	Bees
3	<i>Anisoptera spp</i>	Dragon fly
4	<i>Formicidae spp</i>	Red Ants
5	<i>Ophion spp</i>	Wasps
6	<i>Anopheles quadrimaculatus</i>	Malaria transmitting mosquitoes
7	<i>Pantodon buchholzi</i>	African Butterfly

Source: Kaizen Field Study

The project area has no species that may be considered as endangered species.

5.2.3 BIRDS

5.2.3.1 FIELD SURVEY OF BIRD SPECIES

During the site visit in August 2019 some vegetation was observed on site and which serves to provide habitats for birds, reptiles, insects and other fauna. There was no significant fauna and flora observed during the study. The project site is a brownfield and vegetation in the area had been cleared due to the current operations within project area.

Table 14: Common avifauna in the project area

Avifauna Birds	
Scientific Name	Common Name
<i>Platalea alba</i>	African Spoonbill
<i>Bubulcus ibis</i>	Cattle Egret
<i>Ardea goliathd</i>	Goliath Heron
<i>Ardea cinerea</i>	Grey Heron
<i>Egretta garzetta</i>	Little Egret
<i>Phalacrocorax africanus</i>	Reed cormorant
<i>Pelecanus onocrotalus</i>	White Pelican
<i>Otus senegalensis</i>	African Owl
<i>Tyto alba</i>	Barn Owl
<i>Macheiramphus alcinus</i>	Bat Hawk
<i>Merops persicus</i>	Bee Eater
<i>Campanthera bennettii</i>	Wood Pecker
<i>Halcyon albventris</i>	King Fisher
<i>Circuaetus cinereus</i>	Eagle
<i>Oriolus larvatus</i>	Black Oriole
<i>Treron australis</i>	Pigeon
<i>Oena capensis</i>	Dove
<i>Otus leucotis</i>	White Owl

The district has no bird species that may be considered as endangered species.

5.3 SOCIO-ECONOMIC CONDITIONS

5.3.1 DISTRICT ADMINISTRATION

The District is part of a two-tier system of administration, namely, the Provincial Administration and the District Administration. The Provincial administrative centre is in Solwezi. The District administration for Kasempa District at the Kasempa district centre popularly referred to as the Kasempa Boma. The District Administration, which is headed by the District Commissioner, coordinates the activities of all government departments in the District. The Boma accommodates other Departments of Government line ministries. The local authority is Kasempa Town Council. It retains the responsibility of providing municipal services. The Council Secretary administers the District Council, with the assistance of the Deputy Secretary (Director of Administration), Treasurer (Director of Finance), Director of Works (Engineering) and the District Planning Officer (Planning).

5.3.2 DEMOGRAPHY

Kasempa District has a population of nearly 70,000 (2010), about 10 % of North-Western Province, with a growth rate of 3.0 per cent and a density of 3.3 per square km (Central Statistics Office –CSO- Atlas, 2013, p.109). In 2000 the district population was 52,000. The land surface of the District is about 20,000km². It is worth noting that the population growth rate for the Kasempa is higher than the provincial growth rate. This can be related to a lower rate of outward migration from the District and some in-migration from neighbouring regions. In turn, this may be connected to the fairly good soil and agricultural production and export opportunities in these regions and animal husbandry opportunities.

The total number of households in the Kasempa District is around 12,000. On average, the household size is 5.8 persons. This is slightly higher than the national average of 5.2 persons per household and more than the 5.3 persons per household for rural Zambia. The percentage of female headed households is also about the same as the national average of 23 %. Similar to the national level, there is a high percentage of young population in the district: in the age category of 0-14 years there are 34,600 youngsters, which means that nearly half of the total district population is under the age of 15 years.

5.3.3 ECONOMY

North-western province is endowed with minerals which include; Copper ore in Kalengwa, Kansanshi, Lumwana and Mwinilunga and Gold ore at Kansanshi. Manufacturing is significant. Intensive drilling programme for copper is also planned at the Kalumbila exploration products and includes the Kawako Nickel and Kawanga Uranium prospects. Lumwana is the largest copper mine to have come on line since 2008 (Zambia Review 2010). There are however, grinding mills (on small scale) in almost all the districts and the honey factory in Kabompo and several other honey-processing facilities

Poverty within Kasempa District is rife and is attributed to the fact that there are less economic activities that are available in for the people to engage in apart from farming activities The Central Statistics Office (CSO: 2015) report has revealed that the living conditions of people in North-western Province has remained poor over the years with poverty levels standing at 66.4 per cent (CSO: 2015) while extreme poverty stand at 48.4%

It therefore comes as no surprise that subsistence farming is the most common means of livelihood in the area (80%) followed by charcoal burning (10%) and bee keeping (4%). Other economic activities in the area include petty trade (3.5%), hunting and gathering of game meat and wild fruits and vegetables (2%). The rest of the people are employed by companies currently conducting explorations in the area. The major crops grown are maize, cassava, sweet potatoes, and vegetables. These crops are mainly for household consumption with a few being sold within the communities and occasionally to Kasempa and sometimes to Solwezi town. Most agricultural activities are seasonally conducted during the rainy

season. Also of importance to the People of North Western Province is fish farming (aquaculture activities) in a number of districts such as Solwezi, Kasempa, and Mwinilunga.

Some households keep some cattle, pigs, goats and free-range chickens which are mainly kept as assets with a few being sold or consumed at household level. Charcoal burning is another source of income and most of the charcoal is sold in Kasempa also to the companies operating close to the villages. Bee keeping is also another economic activity for most of the people within the project area. This is normally conducted in the bushes which are closer to the villages. This honey, when processed, is normally sold to Kasempa and Solwezi towns. Some of the bee is also sold to the Copperbelt and Lusaka.

5.3.4 EDUCATION

There are quite a number of schools in Kasempa. The trend is that each area has a school. The schools currently face many problems, which includes insufficient staff, lack of desks for the children to sit on. For the project area, there are a number of community schools and 41 Basic Schools and 3 High Schools. Two of the high schools are boarding. Mukinge Academy is the only private school in the district. The district also has 21 community schools with classes ranging from Grade 1-6. There are 51 Interactive Radio Instruction (IRI) Centres. To support the schools, the district has 227 basic school teachers and 64 high school teachers. These are not enough to adequately cater for the needs of the schools. For example, Shivuma School only has four teachers, who are not on the pay roll, to teach Grades 1-9. The closest school to the site is the Mukinge Girls Secondary School.

5.3.5 HEALTH

The District Health Board (DHB) is responsible for running health matters in the district. There are 14 Rural Health Centres (RHCs). Mukinge Hospital is the only hospital in the district that can handle referral cases. There are only three doctors who are all based at Mukinge Hospital. Provision of health services is difficult in the district due to a number of reasons. The staffing levels in the Rural Health Centres are inadequate. As a result, two of the centres are run by Classified Daily Employees (CDEs). One of these is Nyoka, which was formerly run by the Zambia Flying Doctors Service. It is also difficult for district officials to deliver health services to the rural communities due to the poor road network.

Kasempa District Hospital is the main health facility in the district. However, there are a number of rural health facilities within the district which provide satellite services in rural areas. Common ailments in the district are related to diarrhoea, respiratory system infections, malaria especially during the rainy season and STIs to a much lesser extent. Other services provided at the centre include Under Five, Ante natal, family planning and ART adherence. For serious cases, patients are referred to Kasempa Hospital or Mukinge Mission Hospital.

5.3.6 ENERGY

Kasempa District is connected to the National Grid. However, the settlements within the concession area are not connected to this power. Thus for this project, there will be need to connect the area with Power. This will either be done by Zesco or CEC depending on the company that will offer better rates. All energy for heating and cooking in the village is obtained from charcoal, which is produced in the surrounding Miombo woodland and sold in the village by vendors.

5.3.7 TRANSPORT

Kasempa is accessible from Solwezi on a tarred road that runs through the township up to Mukinge Mission Hospital. All major and feeder roads in Kasempa district are in poor state and under the Roads Department. Major roads include the Kasempa-Muyashi D181, Kasempa-Mumbwa D181/NW/1, Kasempa-Kaoma D301 off D181, Kasempa- Kalulushi M18 off M8, Kasempa Turn-off to Nyansoso M8 and the Kasempa Township to Airfields D302 off D181. The four feeder roads are Kalombe U15,

Shivuma Kamatete U19, Kaungashi Bridge on D181 and Mbulumunene off D181. Most of the people in the project areas use buses for transport for long distances. Bulk goods are transported by road on heavy duty trucks. Some people rely on bicycles and ox-carts for transport.

5.3.8 COMMUNICATION

The area is linked to the rest of the country by Zamtel's microwave satellites. There are three mobile phone operators in the area namely, Airtel, MTN, and Cell Z. Zamtel also provides landline phone services to people in the area. They can also communicate with the rest of the country and the world through the internet. Television and radio networks are available in most parts of the project area.

5.3.9 WATER AND SANITATION

Lufupa River is the main source of water in Kasempa district and provides water to 3,500 people. Other sources of water are boreholes and wells. Mukinge Mission draws water from the natural spring to service about 3,000 people. Urban water supply to Kasempa Township is supplied by North Western Water and Sewerage Company (NWWSC). The company currently supplies water to 440 customers. Water supply is now regular following the connection of the district to the national electricity grid. Water supplying Kasempa is pumped from Lufupa River to a high-level tank from where it is distributed to residents. Water problems occur during the dry season due to the low water level in the river. North Western Water and Sewerage Company is in the process of replacing the old water system.

Rural water supply is the responsibility of the Department of Water Affairs in conjunction with other partners. Rural water supply is mainly through boreholes and shallow wells. Shallow wells and their depths are monitored every month. Two shallow wells at Kabisonga have been selected to help monitor water levels for planning purposes. Trained pump minders are paid in kind by the communities. In line with the policy of trying to instil a sense of ownership, local communities are required to contribute 25% down payment towards the cost of erecting pumps. This has, however, been met with resistance. Foremen are trained to rehabilitate wells. Water shortages are sometimes experienced due to some contractors putting pumps at levels lower than indicated. The district does not have a central reticulation sewerage system. Houses in the township are serviced by individual soak away and septic tanks. There are two sewerage systems in the district. One is at Kasempa Boys Secondary School and the second one is at Mukinge Girls Secondary School. There are three sewerage ponds at Kasempa Boys Secondary School which are supposed to service the individual septic tanks. The sewerage ponds are currently dry due to a leakage. A vacuum pump is available to pump individual septic tanks. The tanker is available on condition that a minimum of 20 people at a time pay for its use. Rural sanitation is through pit latrines.

5.3.10 MINING AND QUARRYING

Mining is the second largest employment sector in Kasempa district after agriculture. The sector employs 400 skilled and unskilled men. Major minerals found in Kasempa are aquamarine, copper, ornamental copper, amethyst malachite, and blue surf has been reported. There are currently three legal mines operating in the district. These are, Jifumpa, Kamankuliba and Njenga. Quarrying is done on a small scale in the district. Mukinge service workshop is also involved in soil collection and quarrying for its various building projects undertaken within the mission.

5.3.11 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 sites are traditional land located in Senior Chief Kasempa's area

5.3.12 LAND USE

The predominant land uses in the project area are mainly agriculture, forest use, commercial and residential establishments, and mining and quarrying.

5.3.13 ARCHAEOLOGICAL

There are no known sites on the project site or surrounding sites that have been confirmed as cultural or archaeological sites.

5.3.14 BUILT ENVIRONMENT

The built environmental observed in the immediate project area during the site visits include schools, health centres and village houses. Among the notable built environment observed include Mukinge Girls Secondary School, Mukinge Hospital and Kivuku Health Centre.

6 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

6.1 POSITIVE IMPACTS

6.1.1 IMPROVED PLANNING AND MANAGEMENT OF AQUACULTURE DEVELOPMENT

Development in defined areas (e.g. safe aquaculture zones in the Chipepo Aquaculture Park) will ensure it occurs in appropriate areas; minimise conflict with other resource users and ensure long term legal rights for production in those areas.

6.1.2 ENCOURAGEMENT FOR THE DEVELOPMENT OF SMALL TO MEDIUM AQUACULTURE PRODUCTION BUSINESSES

To a large extent aquaculture development in Zambia starts at the corporate scale with large farm development set up by larger companies who dominate production. Typically, the development of small to medium sized aquaculture enterprises by small local companies is problematic, but nevertheless important given the potential for smaller operators to encourage remote development providing livelihoods, opportunities for diversification and employment for small communities. However, Aquaculture SME development requires the widespread transfer of appropriate technology, technical support and financial loan facilities to facilitate development. These factors can be better provided and focused when small-scale producers cluster together.

6.1.3 COST SAVINGS AND ECONOMIES OF SCALE

Clustering encourages aquaculture support industries to become established the same area for example, hatcheries, cage construction, net cleaning, net mending, and marketing. This can generate cost savings in input activities, thereby reducing costs throughout the rest of the value chain. Clustering of farms also allows the use of shared infrastructure for example jetties for loading/unloading feed and fish, boat mooring areas, security etc., as well as shared management.

Economies of scale can also be generated for forms of service provision which the private sector may be unlikely to provide on its own, and which it may therefore be appropriate for the Government to provide. Given typical pressure on government budgets, reducing the cost for it to support the sector can be critically important.

6.1.4 DIVERSIFICATION INTO AQUACULTURE BY FISHERMEN AND RURAL COMMUNITIES

The need for fishermen to diversify is already evident in Lake Kariba with declining incomes and declining stocks. The promotion of diversification is a means to ease the transition to reduce fishing pressure on stocks and to provide fishing-dependent communities with new business and employment opportunities.

The choice of target beneficiaries and identification of diversification options to support livelihoods of fishing-dependent people typically depends on the main objectives and the orientation of wider economic development and environmental management policy. Typically, diversification in a fisheries context is promoted to achieve one or more of the following outcomes:

- economic opportunity and stability: improved incomes, diversification of business and earning opportunities and economic growth;
- reduced vulnerability: reduced risks of failure, buffer against seasonality, shocks and adverse trends – e.g. climate change; and

- reduced pressure on natural resources: reduced fishing effort, reduced demands of aquaculture on ecosystem services.

6.1.5 PROVIDE FARMERS WITH KNOWLEDGE AND SKILLS FOR AQUACULTURE ENTERPRISE DEVELOPMENT

Available information indicates that, aquaculture ventures in the country have so far not been very successful because they are undertaken in a rather fragmented set up, tend to be based on few small-scale individual fish farms that are poorly planned, not well organized, lack proper management and unregulated. The proposed project will/is hoped to bring together aquaculture entrepreneurs, with common production targets into organized entities for commercial scale aquaculture production. In addition, this knowledge gap is further widened due to the difficulty associated with promulgating new or innovations and technologies to farmers since aquaculture sites (cages /ponds) tend to be scattered and distant from each other. Consequently, this uncoordinated production system has for long, undermined efforts towards aquaculture development in the country. Therefore, the proposed concept of aquaculture parks is expected to mobilize farmers and bring them together in a coordinated manner to address such enterprise production challenges.

6.1.6 ENHANCED EMPLOYMENT (JOB CREATION)

It is anticipated that over the construction period of the project, direct employment will peak at about 100 people to ensure its implementation; this will include the main contractor's labour force and employees of subcontractors. As far as possible, priority will be given by the Contractor to the employment of labour from local communities within and around the immediate project area. There are generally a relatively low formal skills base and level of education within the local population; therefore, it is expected that most permanent skilled and semi-skilled staff will initially be brought in from other areas although many employment opportunities for casual and general workers will be available for local labour. A deliberate policy of on-the-job training for suitable candidates will be instituted aimed at up-skilling the local labour pool to ensure that as many employment opportunities as possible go to persons from the local communities.

National Level Production

Total average production of the main species farmed fish has significantly risen from 10,291 tons in 2011 to 38,480 tons in 2019 (*Department of Fisheries Annual Report 2019*). It is expected that with the coming of the ZAEDP, farmed fish production will continue to significantly increase.

National Aquaculture Production Progression

YEAR	AQUACULTURE (MT)
2010	
2011	10,291
2012	12,988
2013	20,271
2014	19,281
2015	22,753
2016	30,200
2017	32,888
2018	36,105
2019	38,480

6.1.7 RELIABLE SOURCES OF FINGERLINGS

A survey of farmers conducted by Nsonga (2015⁴) found that most farmers were concerned about input and production constraints, such as inadequate quality of fingerlings, insufficient animal manure, lack of affordable fish feed, insufficient extension services and a lack of mobility to access markets from remote and often isolated pond sites. While numerous government policies and development agencies have attempted to develop and sustain the sector through extension projects, capacity building or the supply of inputs (fingerlings and feed), many projects have not made a significant impact on developing the small-scale sector, mostly because of a lack of being able to provide sustainable options after the implementation phase. In view of these, ZAEDP plans to invest in production of estimated 8.2 million fingerlings in Kasempa and, more so, put in place, measure to ensure such production capacity is enhanced even after the life of the project. In addition, 1 indoor hatchery at the facility will be completed and rendered functional under the project.

6.1.8 INVOLVEMENT OF WOMEN, YOUTH AND VULNERABLE GROUPS IN THE SUBSECTOR

It is clear that during the project a series of multiplier benefits for vulnerable groups (women, youth) will be realized. An estimated 25 emerging (i.e. small and medium scale) aquaculture enterprises will be operational of which, about 40% will be by women. In addition, the project envisages empowering 25 women in decision making at out-grower levels. Furthermore, the project plans to train 200 Young Aqua-prenuers of which, 40% will be women. Other benefits focusing on women will be the plans to 120 proposals from 120 Young Aqua-prenuers for submission and approval for operationalization. All these no doubt, are geared towards development and empowerment of these groups, which will be no mean achievement gender wise from ZAEDP.

6.1.9 NEED TO INCREASE AQUACULTURE-BASED FISH PRODUCTION

By 2014, aquaculture in Zambia grew to a total output of 20,000 t, with three quarters of production coming from the commercial sector, namely intensive pond-based rearing units and cage culture. Zambia is the biggest producer of tilapia in the South African Development Community (SADC), and some of the largest freshwater commercial farms in Africa operate in Zambia (Cocker LM. 2014)⁵. No doubt, while the promotion of aquaculture was prioritized for the small-scale sector through interventionist methods and to boost household fish consumption and food and nutrition security, new approaches today recognize the growing importance of promoting aquaculture as an enterprise, which further justifies aquaculture interventions under the planned ZAEDP.

6.1.10 SUPPLY OF QUALITY FISH FEEDS

One of the limitations to successful aquaculture is limitation of supply of good quality fish feeds. Under ZAEDP in Kasempa, 1 mini feed manufacturing plant will be installed at the facility

6.1.11 IMPROVED FISH PRODUCTION INFRASTRUCTURE

Under ZAEDP a range of infrastructure are to be improved all geared to better handling, processing, storage and transportation of fish. For instance, the service center in Kivuku will be equipped with a fish bulking processing and cold storage facilities as well as rehabilitation of feeder roads from the main road to the service center.

⁴Aquaculture in Zambia: An overview and Evaluation of the Sector's Responsiveness to the Needs of the Poor. CGIAR Research Program on Fish Agri-Food Systems and Lusaka, Zambia: Department of Fisheries. Working Paper: FISH-2017-08

⁵ Cocker LM. 2014. Strategic review on aquaculture markets and export potential. Partnership for African Fisheries. Aquaculture Working Group. Midrand, South Africa: NEPAD

6.1.12 CAPACITY BUILDING IN THE SUB-SECTOR DEVELOPED

There are a number of on job trainings in terms of workshops, study tours as well as training of 15 technical staff (of which, 50% will be female). Three aquaculture Curricula are to be reviewed and improved/developed, 4 fish geneticists are to be trained and 10 technical assistance sessions are to be provided amongst others, which all points deliberate interventions to build the capacity of the subsector for better delivery of the fish commodity.

6.2 PROJECT NEGATIVE IMPACTS

6.2.1 CONSTRUCTION BASED IMPACTS

6.2.1.1 LOSS OF VEGETATION

The process of clearing the site for pond construction and associated infrastructure will lead to loss of vegetation at the project site during the construction phase. Though the site does not have vegetation of conservation concern, the loss of vegetation over earmarked for ponds establishment will be too glaring and damaging to the local environment. As such, the following measures shall be instituted to address vegetation loss impacts;

- ❖ Vegetation clearance should be restricted to those sections of the project required for construction and operation of the specific project infrastructure,
- ❖ Restoration of the damaged sites after clearance shall be carried out especially where vegetation clearance will necessarily go beyond the planned developments,
- ❖ Case by case evaluation using specialists will have to be considered before felling any mature trees on the site, and where possible the designs and plans adjusted to avoid cutting down of such trees and to salvage those harvested for other uses before any clearance.

6.2.1.2 LAND USE IMPACTS IN THE PROJECT CATCHMENT AREAS

Land use activities in the catchment area of a water body can affect the quantity and quality of surface water in its system. For example, the land use patterns in the project catchment area are evidently likely to result in erosion due to run-off and consequently cause significant increases in river sediment. Increased amounts of suspended solids in water, and silt deposits in the rivers, impact negatively on aquatic life (Ferman, 2013)⁶ in terms of:

- ❖ Reduced water clarity which can affect photosynthetic rates in aquatic plants and suspended elements may seal the branchial systems of fish or cause irritation;
- ❖ Muddy deposits reduce the quality of substrates in breeding areas; and
- ❖ Run-off from agricultural lands can carry chemical residues that can be harmful to fish.

Mitigation measures to construction based impacts

The project should invest in source protection activities with a focus on:

- ❖ Protection and conservation of water sources and ecologically sensitive habitats in the vicinity of the project;
- ❖ Create buffer zones at the water sources as well as at the pond sites by instituting community driven protection measures around such areas;
- ❖ Soil and water conservation practices such as afforestation, agro-forestry programmes, grass planting etc. to minimize run-offs.

⁶Ferman, Y., 2013. Subsistence Fish Farming in Africa: *a Technical Manual*. ACF International.

6.2.1.3 CREATION OF BORROW PITS

Construction materials that will be used in the project as; hard core, stones, and sand will be obtained from quarries and sand harvesters who extract such materials from natural resource banks such as rivers and quarries. Since substantial quantities of these materials will be required for the construction of the facilities, the availability and sustainability of such resources at the extraction sites will be negatively affected as some are not renewable in the short term. In addition, the sites from which the materials will be extracted may be significantly affected in ways including landscape changes, clearance of vegetation and opening of depressions on the surface leading to human and animal health impacts.

Mitigation measures

- ❖ Project should access construction materials from existing suppliers without engaging directly in extraction of such materials;
- ❖ In instances where the project directly engages in extraction of such materials, the sites will be fully restored and such restoration be approved by ZEMA and DEOs in areas of Mungwi, Kasempa and Rufunsa as well as project engineers at such sites.

6.2.1.4 MANAGEMENT OF SPOILS DURING CONSTRUCTION

The construction of the ponds will involve excavation of large volumes of earth materials, which will have to be disposed-off in environmentally sustainable manner. Some of those materials will be assessed such that, what is re-usable shall be used in back-filling and compacting of the site areas; and where some farmers are interested in the soils for their farms or for use in brick making by local people, it shall be assessed and access granted to the farmers and brick makers to ferry away from the project site in an agreed and prescribed manner. However, the excess soil will be disposed of at approved sites with guidance from both the Project Engineer.

6.2.1.5 CONCERNS RELATING TO DUST EMISSIONS

Generally, particulate matter pollution is likely to occur during the site clearance, excavation, loading, and transportation of the construction waste.

Mitigation measures

- ❖ Workers need to be in their respective PPEs during working hours.
- ❖ Sprinkle water on graded access routes when necessary to reduce dust generation by construction vehicles.
- ❖ Avoid excavation works during extremely dry weather if possible.

6.2.1.6 IMPACTS RELATING TO FEEDER ROADS IMPROVEMENT

There will be need to improve feeder roads throughout the project areas and that process will trigger loss of roadside business and housings much as it is a small-scale short-term negative impact and is to be mitigated:

- ❖ To the extent feasible, the project will restrict road improvement works to sections of the road needed for the carriageway with objective of keeping to the minimum, the need for land uptake and associated compensation requirements;
- ❖ However, where compensation is inevitable, those project-affected persons (PAPs) will have their properties valued and compensated in line with land acquisition laws of Zambia; and
- ❖ Notifying the PAPs in advance to relocate their business to avoid disruption during works.

6.2.1.7 IMPACT OF NEW INFRASTRUCTURE CONSTRUCTION

6.2.1.7.1 NOISE GENERATION

Constructions of the proposed project will most likely result in noise emissions as a result of the machines that will be used e.g. excavation equipment and construction vehicles delivering materials to site. Noise will also be generated by construction workers. Significance of noise impacts depends on whether the project would increase noise levels above the existing ambient levels by introducing new sources of noise.

Noise impacts would be considered significant if the project would result in the following:

- ❖ Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- ❖ Exposure of persons to, or generation of, excessive ground-borne vibration or ground-borne noise levels; and
- ❖ A substantial permanent increase in ambient noise levels (more than 3dBA) in the project vicinity above levels existing before the project.

A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing before the project. The project proponent through the contractor shall put in place several measures that will mitigate noise pollution during the construction phase such as the following:

- ❖ Install portable barriers to shield compressors and other small stationary equipment where necessary;
- ❖ Use of quiet equipment (i.e. equipment designed with noise control elements);
- ❖ Limit pickup trucks and other small equipment to a minimum idling time and observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible;
- ❖ Provision of appropriate personnel protective equipment (PPE);
- ❖ Construct mainly during the day; and
- ❖ Consider labour based construction methodologies.
- ❖ The provisions of EMA should be observed

6.2.1.7.2 DUST EMISSIONS

Dust will be emitted during excavation and related earthworks. Air-borne particulate matter pollution is likely to occur during the excavation works. This is likely to affect site workers, in extreme situations leading to respiratory problems. To ameliorate these, the following mitigations measures are proposed:

- ❖ Minimizing the number of motorized vehicles on use;
- ❖ Rehabilitate disturbed areas;
- ❖ Provide scour checks on over-15% slopes or when working in loose soils; and
- ❖ Use predetermined tracks.

6.2.1.8 ISSUES OF HIV/AIDS PREVALENCE AMONGST FISHER COMMUNITY

The project needs to probe into the dynamics of the HIV/AIDS amongst fisher communities and there are fears of risks of HIV/AIDS infections occasioned by mix of workforce and resident communities. It is noted that, the area has high HIV/AIDS prevalence hence the following measures are needed in place: ***project to works with existing HIV/AIDS interventions in the area to extend services to their workers.***

6.2.1.9 CHILD LABOUR ISSUES IN THE PROJECT

From the on-set and in line with the national laws and policies, prohibits the employment of children under the age 12 years. Furthermore, the National labour law prohibits the engagement of children 12-13

years in any employment except for light work carried out under the supervision of an adult aged over 18 that does not affect the child's education. *The District Labour Officer Kasempa and Department of Fisheries, take the lead to monitor compliance with this requirement.*

6.2.1.10 GENERATION OF EXHAUST EMISSIONS

Exhaust emissions are likely to be generated during the construction period by the various construction machinery and equipment operations. Equipment used for various operations and materials for construction potentially causes air quality impact by emitting pollutants through gaseous exhaust emissions.

Mitigation measures to exhaust emissions

- ❖ Proper and prompt maintenance of construction plants and equipment to control emission of hazardous fumes and noise emanating from machines;
- ❖ Equipment used to be of sound mechanical condition; and
- ❖ Ensure that machines are switched off when not in use.

6.2.1.11 STORM WATER AND WATER RUNOFF IMPACTS

Likely to arise from the site may run into nearby Kivuku and Mpungu Rivers, and with its loads of sediments is likely to cause interference to the construction operation and also the water quality and sediment loading. This is to be mitigated through ensuring the surface is cleared off loose soils and compaction of the site coupled with planting vegetation on the site.

6.2.1.12 OCCUPATIONAL HEALTH AND SAFETY RISKS

The occupational health and safety risks envisaged at this stage are likely to include constructional accidents, injuries, fatigue, dehydration and associated bodies injuries. Some of the precautionary measures for prevention and control of OHS risks will include:

- ❖ The first and immediate of management of risks associated with the project will be to enclose the ponds and ensure regulated access to check out risks of drowning from the general public;
- ❖ Using appropriate PPE (e.g. insulated gloves and shoes, goggles and clothing to protect against excess heat); and
- ❖ Implementation of work rotations would provide regular work breaks and provision of drinking water for the workers will reduce such risks;
- ❖ Having in place, clear signage in access and transportation routes and working areas in the project settings;
- ❖ Appropriate design and layout of facilities to avoid crossover of different activities and flow of processes;
- ❖ Implementation of specific load handling and lifting procedures.

6.2.1.13 IMPACT OF SOLID WASTE MANAGEMENT

Construction activities create solid wastes that need to be disposed. Such wastes include: plastic containers, cement bags and other packaging materials; and metal offcuts, glass, plastic containers and other unwanted materials. Disposal of the same solid wastes off-site could also be a social inconvenience if done in wrong places. The off-site effects could be un-aesthetics view, pest breeding, unhygienic conditions and pollution of physical environment.

Mitigation measures to solid waste

- ❖ Provide solid waste handling facilities such as waste bins;
- ❖ Ensure that solid waste generated is regularly disposed of appropriately at authorized dumping sites;
- ❖ Ensure that the waste is managed efficiently through recycling, reuse and proper disposal procedures; and
- ❖ Proper waste management will be taken into consideration and proper dumping done according to the waste management guidelines as enshrined in the applicable environmental management tools.

6.2.2 OPERATIONAL BASED IMPACTS

6.2.2.1 IMPACTS RELATING TO WASTES FROM PONDS

Inappropriate disposal methods of green water pumped out from the ponds, which will have considerable amounts of nutrients such as phosphates and nitrates, can result into overgrowth of plant if this is disposed of on land or in an aquifer. The green water will not directly be disposed of on land or in a body of water but will be discharged into a settling pond from which the water will be released into the lake. This measure will ensure that the water meeting biological, physical and chemical parameters is released into the stream.

Mitigation measures to wastes from ponds

- ❖ It is suggested that, the design of the pond based aquacultures should be with an option of removal of nutrients from the effluent water before discharge in the water system. A sludge separation unit will be built after the flow through raceways and will include a sedimentation pond and filtration system to remove the large part of suspended organic wastes. The remaining suspended solids will settle and will be trapped in the final sedimentation pond while 80% of the dissolved P and N will also be trapped in the sludge and with some taken up by the algae and water plants within the production ponds and the sedimentation ponds;
- ❖ The pond sediment and the water plants should be regularly removed and can be used as soil improving materials and fertilizers for agricultural production; and
- ❖ This type of pond also will work as constructed wetland to decompose organic material and remove the dissolved nutrients from the water.

6.2.2.2 POTENTIAL REDUCTION IN DOWNSTREAM FLOWS

According to the production model for the ZAEDP, the estimated volume of the flow-through waters to the ponds could be lower than water flow in the river system. This means that the highest volume of discharged water will be overall low. Uncontrolled abstraction of water for fish production without due consideration to the river environment can likely to lead to decrease in downstream flows of water with attendant environmental and social impacts. This could raise risks of conflict with downstream water demands for a range of identified uses such as watering livestock, domestic needs and a host of other needs. This volume is negligible taking into consideration that, there will be a daily recharge from the ponds to the river.

6.2.2.3 RISKS OF FISH DISEASES OUTBREAKS

African fish types are known to be of high resistance to diseases and water quality and where disease develops, that is sometimes attributed to environmental or management problems of the fish farms. These said, disease and parasite outbreaks in fish farms, though infrequent, can spread rapidly among farmed fish ponds because of the high densities at which they are kept, and under which, disease may spread to wild fish populations. Mitigation can be in that, for dead fish, the ponds should be checked daily for any dead fish which should be collected and removed from the ponds, examined for any signs of disease or infection, and disposed of by burying in a pit on-shore and any unusual fish state is reported to the veterinarian and early.

Other measures to mitigate disease outbreaks include:

- ❖ Applying good animal husbandry and management practices;
- ❖ Maintaining good water quality in all rearing units;
- ❖ Conducting routine inspections of farm stocks to observe behaviour and early indications of health problems and stress;
- ❖ Using stocking densities, handling techniques and feeds that are appropriate to the species and size of fish;
- ❖ Implementing appropriate biosecurity measures; and
- ❖ Using immuno-stimulants and vaccines, where appropriate.

- ❖ All fingerlings being transferred onto the ponds should be checked and declared disease free and are routinely checked how they are adjusting to the captive water environment to ensure that they are not infected;
- ❖ Proper stocking density—in addition to causing stress, high-density conditions increase the frequency of contact among individual fish, leading to increased rates of disease transmission and infection hence, the ponds ought to be properly stocked based on established carrying capacities;
- ❖ Fish should be monitored closely during routine feeding to ensure that the fish are eating well and are healthy and any suspect animals should be removed immediately;
- ❖ If the fish is found to be diseased, then the situation should be reported to the veterinarian and authorities for further diagnosis and management in accordance with WHO Aquatic Animal Health Code (2018);
- ❖ The ponds are to be checked daily for any dead fish which should be collected and removed from the ponds, examined for any signs of disease or infection, and disposed of by burying in a pit off-shore area;

6.2.2.4 WATER POLLUTION RISKS

Fish feeds, hormones and other nutrients is feared by the stakeholders as escapes of such materials will likely lead to eutrophication and development of algal blooms with leads to pollution of the water body. The design of the ponds is to provide possible solutions for the reduction of the environmental impact of the discharge i.e. separate the thick sludge of fish wastes and removal of the nutrients from the effluent water before discharge it in the river.

Mitigation measures to water pollution risks

Feed is the primary but also costly input in aquaculture fish farming technologies, and techniques have been developed to avoid its wastage, which will include;

- ❖ using good quality floating feeds which remaining floating on surface of the water; and
- ❖ Other measures will include use of sedimentation ponds where suspended solids will be trapped and settled in the ponds and any nutrients will be taken up by the algae and water plants in the pond. The pond sediment and the water plants will be routinely removed and used as soil improving materials and manure for agricultural production.

6.2.2.5 IMPACT RELATING TO PREVALENCE OF MALARIA AND RELATED DISEASES

Construction of fish ponds will lead to ponding of water thereby providing breeding grounds for mosquitoes and other water borne and water based disease which can cause malaria and a host of other intestinal based diseases. This implies, project infrastructures such as fishponds and the reservoirs present a risk in terms of malaria vector (mosquitoes) breeding and prevalence of malaria.

Mitigation measures to prevalence of malaria and related diseases

- ❖ Need to effectively collaborate with some of the on-going malaria control interventions in the area such as Malaria Control Programs through their on-going prevention activities aimed at life-saving interventions that have a dramatic impact upon the burden of malaria (activities include promoting behavioural change and informing families on malaria prevention and protection through supporting community initiatives such as Information Education and Communication and Behaviour Change Communication programs);
- ❖ Malaria Control Programs could be involved in the distribution of long lasting insecticide treated nets through campaigns and health facilities; and
- ❖ Collaboration with existing health facilities to deliver treatment to project staff and farmers not only treatment of malaria but also other ailments.

6.2.2.6 CONCERNS REGARDING LABOUR INFLUX TO THE AREA

Once the project works are launched, there are risks relating to labour influx in which, those seeking employment or enterprises opportunities begin to come into the area hoping to sell goods and services to the temporary project workforce, as well as “associates” who often follow the first two groups to exploit opportunities for criminal or illicit behaviour (e.g. prostitution and crime). Typically, in circumstances where labour/skills and goods and services required for a project are not available locally⁷. Labour influx is likely to occur during or just prior to construction of a project or over a finite time-period when significant excess labour capacity is required. Over a matter of weeks, a significant number of people may come to reside in a project area and this is likely to scale both up and down during the course of construction, resulting in unpredictability.

Other the key impacts include the following:

- a. **Environmental:** population pressure may lead to expanded use of natural resources and aquatic resources, induce water needs of worker camps resulting into increased pressure on freshwater resources in the project or camp areas;
- b. **Economic and livelihood strategies:** influx, when significant in relation to local community size, can result in increased pressures on the demand for food, fuel and land thereby exacerbating economic vulnerability of marginal groups (e.g., women, youth, elderly);
- c. **Health:** labour influx can provoke higher rates of violence, injury, alcohol and drug consumption and sexually transmitted diseases in the local population thereby putting stress on health service infrastructure and services delivered; and
- d. **Social and community wellbeing:** labour influx can have effects on community cohesion. This can be particularly acute in smaller communities hosting a largely male workforce, and/or a workforce from other regions which may result in conflicts between locals and non-locals concerning employment opportunities, wages, and women.

Mitigation measures

- ❖ Recruiting mainly local people from the community on most of non-skilled aspects in the project thereby checking influx as such, relieving pressure on environment and natural resources;
- ❖ Working with existing service institutions to provide HIV/AIDS counselling services and treatment as well crime prevention especially the police;
- ❖ Collaborating with areas local leaders and police to curb instances of Sexual and Gender-Based Violence (SGBV) in and around the project.

6.2.2.7 RISKS OF ACCIDENTS RESULTING FROM DROWNING

The fish ponds can present risks of drowning by the children who could be lured to swim in such ponds or directly going to fish in such waters. In some cases, livestock could easily drown in such ponds.

Mitigation measures to accidents resulting from drowning

- ❖ Operating personnel must have lifesaving gears and ensure such lifesaving gear is worn by all persons working in project;
- ❖ Put in place, an effective communication system and warning or alerting system in case of any danger in the project;
- ❖ Have at least two or three people trained as lifeguards with always one on site all the time people are on the lake; and
- ❖ Continued public education, and sensitization on the dangers involved in fishing in expansive water body alongside first aid training in emergency preparedness plan (Annex).

6.2.2.8 FUEL STORES OPERATIONS

⁷ Daniel Owen (World Bank) with Jay Wagner; Susan Dowse; Murray Jones; Marla Orenstein (Plexus Energy); IAIA18 Conference Proceedings Environmental Justice in Societies in Transition 38th Annual Conference of the International Association for Impact Assessment 16-19 May 2018 | Durban Intl. Convention Center | Durban | South Africa | www.iaia.org

Fuel for the project equipment will be purchased for tractors; forklift and trucks in large quantities and stored on the farm. The store will consist of a concrete platform with fencing, and a double door access to allow easy discharge of full drums. It will have a roof at standard heights.

6.2.2.9 BIOSECURITY ISSUES IN THE PROJECT

Biosecurity in aquaculture is of critical importance and covers issues such as control of pathogen entry and proliferation being an essential aspect of any intensive animal production unit and is one of the most difficult challenges facing the aquaculture industry worldwide⁸.

In this case, Biosecurity focus be on the following:

- ❖ Appointment of a biosecurity focal person;
- ❖ Having in place, registered veterinary health contacts; and
- ❖ Providing staff training in fish health management and disease recognition.

The project is also to implement risk limitation measures such as:

- ❖ Train all staff to comply with all biosecurity measures;
- ❖ Early identification of disease through regular stock inspections;
- ❖ Training staff to recognize clinical signs of disease and enable them to identify procedures that carry a risk of introducing or spreading disease;
- ❖ Ensure that fish husbandry techniques are suitable for the species being held or cultivated;
- ❖ Inform visitors of biosecurity measures and what they have to do;
- ❖ Use suitable disinfectants and disinfection procedures for personal protective equipment and other equipment;
- ❖ All protective clothing must be disinfected and then washed in clean water every week;
- ❖ All equipment (including nets, buckets, bins, graders and pumps, etc.) must be disinfected after use; and
- ❖ Each site should have a biosecurity diary where all details of biosecurity operations will be recorded, i.e. footbath changes, visitors, and deliveries, etc.

6.2.2.10 OCCUPATIONAL HEALTH AND SAFETY ASPECTS IN THE PROJECT

The implementation process for the project is likely to trigger a couple of concerns ranging from accidents on the site, injuries as well as HIV/AIDS and child labour concerns. It is suggested that, these could be addressed through implementation of the following measures will be implemented to mitigate the impacts;

- ❖ Registration of the site as a workplace during the construction and operations in with MoLSS requirements for construction sites;
 - ❖ The designs for the infrastructure be subjected to mandatory approvals by respective agencies such as Districts Departments of Engineering, Public Health and MoLSS;
 - ❖ The project should have on site, an Occupational Health and Safety specialist responsible for
 - ❖ Routine OSH supervision of the site by the mandated Departments in MoLSS.
- ❖ Grievance redress mechanisms Risk of squandering all the money among the fisher folks thus, a need for financial literacy through various capacity building initiatives that target individuals and households. There could also be potential issues of commercial sexual work, sexual exploitation and abuse which could be managed through establishing working relation and collaboration with local law enforcement agencies in and around the project site.

⁸ Farm Africa August, 2016: Strategic Environmental Assessment and Environmental Management Plan for Kenya Market-Led Aquaculture Program, Nairobi

7 ANALYSIS AND EVALUATION OF IMPACTS

Any project affects the environment and community where it is being implemented. The objective of this section is to predict and to assess the potential impacts of the aquaculture park and infrastructure development in Kasempa and to recommend mitigating measures to be incorporated into the project design. The assessment of the issues will be conducted according to a synthesis of criteria required by the integrated environmental management procedure defined as follows:

7.1 NATURE OF IMPACT

This is an appraisal of the type of effect the proposed activity would have on the affected environmental component. Its description should include what is being affected and in what way.

7.2 DIRECT IMPACT

Direct impact is an impact that appears immediately as a result of an activity of the project. For example, the loss of vegetation within the project area is a direct impact and occurs during excavation.

7.3 INDIRECT IMPACT

An indirect impact is an impact that is related to the project but that arises from an activity of the project at a secondary level.

7.4 SPATIAL EXTENT

This is the physical and spatial size of the impact. It is a description of whether the impact would occur on a scale described as follows:

- a. **Site**, the impact could affect the whole or measurable portion of the site. Whether it is limited to the immediate area of the proposed project;
- b. **Local**, the impact could affect the extended area adjacent to the site perhaps a neighbourhood or small town. Whether it would affect environs up to 15km outside the immediate environment;
- c. **Regional**, that impact could affect the area including the outlying areas of the city, the transport routes and the adjoining towns.
- d. **National**, the impact could be as far reaching international boundaries.

7.5 DURATION

The lifetime of the impact; this is measured in the context of the lifetime of the proposed development.

- a. **Short term**, the impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase.
- b. **Medium term**, the impact will last for the period of the construction phase, thereafter it will be entirely negated.
- c. **Long term**, the impact will continue or last for the entire operational life of the development but will be mitigated by direct human action or by natural processes thereafter.
- d. **Permanent**, the only class of impact which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.

7.6 INTENSITY

A description of whether or not the intensity (magnitude) of the impact would be high, medium, low or negligible (no impact). An attempt will be made to quantify the impacts on components of the affected environment and will be described as follows: Is the impact destructive, or benign? Does it destroy the impacted environment, alter its functioning, or slightly alter it? These are rated as follows:

- a. **Low**, where the impact will not have significant influence on the environment, and this will not be required to be significantly accommodated in the project design or implementation; the impact alters the affected environment in such a way that natural processes of functions are not affected in any significant way.
- b. **Moderate**, where it could have an adverse influence on the environment which would require modification of the project design or alternative implementation schedules; the affected environment is altered, however, function and process continue, albeit in a modified way.
- c. **High**, where it could have significant influence on the environment but cannot be mitigated or be accommodated by the project environment by introducing alternative mitigation measures such as realignment at a particular stretch or adoption of different design measures. Function or process of the environment is disturbed to the extent where it temporarily or permanently ceases. This will be a relative evaluation within the context of all the activities and the other impacts within the framework of the project. Note that some impacts have a high intensity and a short duration with no permanent effects.

7.7 PROBABILITY

This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows:

- a. **Unlikely**, the probability of the impact occurring is very low, due to either the circumstances, design or experience.
- b. **Possible**, the impact could possibly happen, and mitigation planning should be undertaken.
- c. **Probable**, it is most likely that the impact will occur at some or other stage of the development. Plans must be drawn up before the undertaking of the activity.
- d. **Definite**, the impact will take place regardless of any prevention plans, and only migration actions or contingency plans can be relied on to contain the effect.

7.8 DETERMINATION OF SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics or combination of effects. Significance is an indication of the importance of the impact in terms of physical extent, intensity and time scale, and therefore indicates the level of mitigation required.

The classes are rated as follows:

- a. **Negligible**, the impact is not substantial and does not require any mitigation action.
- b. **Low**, the impact is of little importance, but may require limited mitigation.
- c. **Moderate**, the impact is of importance and therefore considered to have mitigation. Mitigation is required to reduce the negative impacts to acceptable levels or positive impacts maximized.
- d. **High**, the impact is of great importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential. Positive impacts should be enhanced as a priority.

From the baseline information assembled in the previous chapter coupled with the information gained during the consultation stage, the expected environmental impacts can be categorized into positive and negative impacts. In addition, it is important to consider the duration of the impact and at what phase of the project it occurs, i.e. impacts during the construction phase or impacts over the life of the project

(operational phase) and whether the impacts are *direct* (i.e. removal of vegetation) or *indirect*). The direct impacts would be experienced mainly during the construction process, and include effects on the physical environment, health and safety of the residents within the project area and the construction workers during the construction phase.

Table 15: Evaluation of Impacts

Aspect	Potential Impact	Type of Impact	Spatial Extent	Duration	Intensity	Probability	Determination of Significance
Construction Phase							
Construction Phase	Loss of vegetation on the site	Direct	Site	Medium term	Moderate	Probable	Moderate
	Creation of borrow areas and landscape degradation.	Direct	Site	Medium term	Moderate	Probable	Moderate
	Generation of cut to fill materials whose disposal can cause environmental concerns.	Direct	Site	Medium term	Moderate	Probable	Moderate
	Contamination of water from construction equipment and vehicles.	Indirect	Local	Medium term	Moderate	Probable	Moderate
	Siltation and increased sediment load.	Indirect	Local	Long term	Moderate	Possible	Moderate
	Contamination of water source due to discharge of wastewater at campsites.	Indirect	Local	Long term	Moderate	Possible	Moderate
	Increase of noise levels exceeding levels permitted by regulations	Direct	Site	Medium term	Moderate	Probable	Moderate
	Concerns over generation of dust emissions	Direct	Site	Medium term	Moderate	Probable	Moderate
	Impacts of construction-based waste (packaging materials, off-cuts, excess cut to spoil).	Direct	Site	Medium term	Moderate	Probable	Moderate
	Water pollution of receiving water bodies	Direct	Site	Medium term	Moderate	Probable	Moderate
	Health and safety of workers and passers-by and damage to adjacent properties	Indirect	Local	Long term	Moderate	Possible	Moderate
	HIV/AIDS and influx of workers will cause further spread of this disease and others such as malaria	Indirect	Local	Long term	Moderate	Possible	Moderate
	Possible impact on cultural resources arising from possible excavations works (accidental discovery of graves etc.).	Direct	Site	Medium term	Moderate	Probable	Moderate

Aspect	Potential Impact	Type of Impact	Spatial Extent	Duration	Intensity	Probability	Determination of Significance
	Child labour concerns in the project.	Direct	Site	Medium term	Moderate	Probable	Moderate
	Management concerns over storm water from the excavated surfaces.	Direct	Site	Medium term	Moderate	Probable	Moderate
Operation Phase							
Operation Phase	Arising from possible poor storage and expiry of feeds.	Direct	Site	Medium term	Moderate	Probable	Moderate
	Spread of diseases to wild populations and evolution of drug resistant fish Pathogens.	Direct	Site	Medium term	Moderate	Probable	Moderate
	Eutrophication concerns.	Direct	Site	Medium term	Moderate	Probable	Moderate
	Pollution of river system within and surrounding the site.	Direct	Site	Medium term	Moderate	Probable	Moderate
	Affecting the health and wellbeing of the communities.	Indirect	Local	Long term	Moderate	Possible	Moderate
	Risks of fires and spillages	Indirect	Local	Long term	Moderate	Possible	Moderate
	Changes in the weather likely to cause storms, water temperatures and production dynamics.	Direct	Site	Medium term	Moderate	Probable	Moderate
Post Closure Phase							
Post Closure Phase	General safety of employees on the project area Safety	Direct	Site	Medium term	Moderate	Probable	Moderate
	Improper decommissioning and closure practices can leave the site aesthetically intrusive	Direct	Site	Medium term	Moderate	Probable	Moderate
	Ensure that the final landform is hydrologically compatible with surrounding areas	Direct	Site	Medium term	Moderate	Probable	Moderate

Aspect	Potential Impact	Type of Impact	Spatial Extent	Duration	Intensity	Probability	Determination of Significance
	Discharge of green water from the pond may contaminate surface watercourses.	Direct	Site	Medium term	Moderate	Probable	Moderate
	Localised deteriorations in the air quality from dust generated from open areas.	Indirect	Local	Long term	Moderate	Possible	Moderate
	Un buried ponds will cause a physical and health hazard to the community	Indirect	Local	Long term	Moderate	Possible	Moderate
	Contamination of surface water from storm water contaminated by ponds material	Direct	Site	Medium term	Moderate	Probable	Moderate
	Local contamination from wind erosion on exposed surfaces of the project area	Direct	Site	Medium term	Moderate	Probable	Moderate

Table 16: Positive Impacts and Enhancement measures

Phase	Impact	Enhancement measures	Type of Impact	Spatial Extent	Duration	Intensity	Probability	Determination of Significance
Social-Economic impacts								
Construction	Skilled and unskilled labour will be required.	Employ local people as far as possible unless the required expertise cannot be found locally	Direct	local	Long term	Moderate	Probable	Moderate
		Improve salaries and conditions of service for staff.	Direct	local	Long term	Moderate	Probable	Moderate
	Provision of services to the construction teams, such as sale of food and beverages	A designated place will be established along the project corridor where food and beverages can be sold to construction teams.	Indirect	Local	Short term	Moderate	Probable	Moderate
Operational	Supply of quality fingerlings and fish	Employing cost effective production systems without compromising quality.	Direct	Local	Long term	High	Probable	Moderate
	Enhancing the nation's economy through paying of taxes and pay as you earn remittances	Sustained plant and business operation together with payment of all applicable taxes and levies	Indirect	National	Long term	Moderate	Moderate	Moderate

8 ENVIRONMENTAL AND SOCIAL AND MONITORING PLAN

8.1 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

In order to mitigate the potential negative environmental and social impacts of the Zambia Aquaculture Enterprise Development Project, the envisaged mitigation measures include in the Environmental and Social Management Plan (ESMP) summarized in the Table below:

Table 17: Environmental and Social Management Plan for Aquaculture Ponds Development

Nº.	Aspect	Potential Impact	Mitigation/Enhancement Measures	Frequency of monitoring	Performance Indicator	Time Frame	Responsible Entity	Cost in USD
Construction Phase								
1.	Site preparatory works and clearance	Loss of vegetation on the site	Restrict vegetation clearances to areas for the project. Site restoration and revegetation.	Weekly	Clearance restricted to required areas.	Construction Phase	Site Manager, Department of Fisheries. District Environmental Officer.	5,000
2.	Extraction of project construction materials	Creation of borrow areas and landscape degradation.	The areas to be fully restored at the end of the project; and To access materials from existing suppliers such as stones, sand and hard-core materials.	Weekly	No new borrow pits created	Construction Phase	District Environment Officers, Site Manager	15,000
3.	Excavation for fish ponds	Generation of cut to fill materials whose disposal can cause environmental concerns.	<ul style="list-style-type: none"> ❖ Where feasible, some of the cut to fill materials can be used in back-filling of the project areas; ❖ The excess and unusable cut to fill will be transported and disposed outside the project in areas approved by both the Engineer and, the District Environment Officers. 	Monthly	Usable of cut to fill material.	Construction Phase	Project Engineer, Site Manager, Department of Fisheries District Environment Officers.	40,000
4.	Water	Contamination of	❖ Provide adequate soil	Daily	No	Construction	Site Manager,	30,000

Nº.	Aspect	Potential Impact	Mitigation/Enhancement Measures	Frequency of monitoring	Performance Indicator	Time Frame	Responsible Entity	Cost in USD
	quality/pollution.	water from construction equipment and vehicles. Siltation and increased sediment load. Contamination of water source due to discharge of wastewater at campsites.	erosion control measures. ❖ Specific sites to be gazetted for onsite maintenance of machinery. ❖ Provide septic tanks (or other appropriate sewage collection and treatment scheme) to service the toilet facilities of workers.		contamination of Kivuku stream, Mpungu and Lufupa Rivers	n Phase	Project Engineer, Department of Fisheries, District Environmental Officer. Kasempa Town Council.	
5.	Noise and vibration	Increase of noise levels exceeding levels permitted by regulations	Construction activities should be carried out during normal working hours. Provide boundary walls with vegetative barrier to reduce noise levels; and Providing construction workers with noise suppressors.	Daily	Noise levels within acceptable limits	Construction Phase	Site Manager, Project Engineer, Department of Fisheries, District Environmental Officer. Kasempa Town Council.	10,000
6.	Works such as excavations of the ponds	Concerns over generation of dust emissions	Provide PPEs to the workers; Sites with exposed surfaces be sprinkled routinely to suppress dust generation.	Daily	Dust levels within acceptable limits	Construction Phase	Site Manager, Project Engineer, Department of Fisheries, District	10,000

Nº.	Aspect	Potential Impact	Mitigation/Enhancement Measures	Frequency of monitoring	Performance Indicator	Time Frame	Responsible Entity	Cost in USD
							Environmental Officer. Kasempa Town Council.	
7.	Generation of construction waste.	This will generate a host of construction-based waste (packaging materials, off-cuts, excess cut to spoil).	All construction waste will be collected and disposed off the site in approved dumpsite; and The site be cleaned and fully restored at the end of works.	Weekly	Good house keeping	Construction Phase	Site Manager, Project Engineer, Department of Fisheries, District Environmental Officer. Kasempa Town Council.	100,000
8.	Waste production (solid waste and wastewater from the construction and camp sites)	Water pollution of receiving water bodies	Regular collection and recycling of construction wastes Handling and storage of potential contaminants under strict conditions	Weekly	No water pollution Collection and recycling of waste.	Construction Phase	Site Manager, Project Engineer, Department of Fisheries, District Environmental Officer. Kasempa Town Council. WARMA	10,000
9.	Impact of construction	Health and safety of workers and	Wearing of safety gadgets such as hard	Daily	No health and safety	Construction Phase	Contractor	20,000

Nº.	Aspect	Potential Impact	Mitigation/Enhancement Measures	Frequency of monitoring	Performance Indicator	Time Frame	Responsible Entity	Cost in USD
	activities on welfare and safety of workers and passers-by	passers-by and damage to adjacent properties	hats, gloves, rubber boots, goggles, etc. will be a mandatory requirement of workers. Post safety signs/reminders in strategic areas within the construction area. Install sufficient lighting in poorly lit areas. Install perimeter fence to prevent accidental or unwanted entry of people.		accidents recorded.			
10.	Spread of HIV/AIDS, malaria and other killer diseases among construction workers and community	HIV/AIDS and influx of workers will cause further spread of this disease and others such as malaria	Provide information and sensitize workers on HIV/AIDS and other communicable and killer diseases; and Provide insecticide treated nets for the workers and those near the project fishponds.	Monthly	No new infections recorded.	Construction Phase	Site Manager, Project Engineer, Department of Fisheries, District Environmental Officer. Kasempa Town Council.	15,000
11.	Excavation works and site set up	Possible impact on cultural resources arising from possible excavations	The Project to provide facilitation to relocate and salvaging of such resources whenever encountered.	Daily	Promote cultural recoveries	Construction Phase	Site Manager, Project Engineer, Kasempa Town	20,000

Nº.	Aspect	Potential Impact	Mitigation/Enhancement Measures	Frequency of monitoring	Performance Indicator	Time Frame	Responsible Entity	Cost in USD
		works (accidental discovery of graves etc.).					Council. National Heritage and Conservation Commission.	
12.	Employing children below 18 years in the project	Child labour concerns in the project.	The Contractors to ensure children below 18 years are not employed in the project.	Every after 3 months	No employment of less than 18 years.	Construction Phase	Site Manager, Kasempa Town Council.	10,000
13.	Issues of storm water discharge	Management concerns over storm water from the excavated surfaces.	The site be cleared and cleaned off any loose surfaces. Compaction of the site after works.	Daily	No storm water on site	Construction Phase	Site Manager, Project Engineer Kasempa Town Council.	10,000
Operation Phase								
1.	Management and disposal of stale fish-feeds.	Arising from possible poor storage and expiry of feeds.	Safe disposal of stale fish feeds through burying. Checking of expiry dates.	Daily	No disposal of expired feeds.	Operation Phase	Department of Fisheries Kasempa Town Council.	20,000
2.	Fish diseases	Spread of diseases to wild populations and evolution of drug resistant fish Pathogens.	Practice good husbandry Limit use of chemicals by the use of preventive measures. Quarantine introductions.	Daily	Incidences of fish diseases Fish mortalities	Operation Phase	District Fisheries Officer District Environment Officer	100,000
3.	Water pollution	Eutrophication	The water from ponds to	Monthly	No signs of	Operation	District	40,000

Nº.	Aspect	Potential Impact	Mitigation/Enhancement Measures	Frequency of monitoring	Performance Indicator	Time Frame	Responsible Entity	Cost in USD
	risks from fish wastes and antibiotics residues.	concerns.	be subject to sedimentation and later discharged back to the streams.		eutrophication	Phase	Fisheries Officer District Environment Officer , ZEMA, WARMA	
4	Fish feeds, hormones and other chemicals used for treatment of fish may contaminate the natural receiving water systems.	Pollution of river system within and surrounding the site.	Use of high quality fish feed and properly trained fish feeders that feed fish only up to satisfaction. Ensuring treatment is done using the right chemicals and hormones Use of public health and education with the aqua-park fish farmers.	Monthly	No pollution river systems within and surrounding the site.	Operation Phase	District Fisheries Officer District Environment Officer , ZEMA, WARMA	25,000
	Incidence of malaria and other water based diseases	Affecting the health and wellbeing of the communities.	Educating and sensitizing fishpond operators on the need to sleep inside insecticide treated nets.	Monthly	N out breaks of diseases.	Operation Phase	Officer District Environment Officer , ZEMA, WARMA	20,000
6	Project fuel storage operations	Risks of fires and spillages	Have in place, fire-fighting equipment fully serviced and operational. Fuel storage areas be of cement floors for ease of recovery of any spillages.	Weekly	No sign of hydro carbon spillages	Operation Phase	Aquaculture Manager, District Environment Officer , ZEMA,	10,000

Nº.	Aspect	Potential Impact	Mitigation/Enhancement Measures	Frequency of monitoring	Performance Indicator	Time Frame	Responsible Entity	Cost in USD
7	Climate change fears	Changes in the weather likely to cause storms, water temperatures and production dynamics. Possible water shortage from drought impacts	Sensitization about Emergency Response Plan actions. Have a water reservoir in place				ZEADP/MoL F	15,000
Post Closure Phase								
1	Safety	General safety of employees on the project area	Warning signs in English and local languages will be erected around all working areas	Monthly	No. safety incidents recorded	Operational Phase	Project Manager	7,500
2	Aesthetics	Improper decommissioning and closure practices can leave the site aesthetically intrusive	The area will be re-profiled to establish the natural drainage pattern.	Quarterly	Area, ha, rehabilitated	Post Closure	Director	10,000
3			Salvage all reusable and recyclable materials and scrap of good value will be salvaged and sold off while office buildings may be let intact and used for other purposes.		Weight, kgs, of salvaged materials	Post Closure	Director	10,000
4			Carry out site levelling and re-profiling shall be done to re-establish the natural drainage pattern	Quarterly	Area, ha, rehabilitated	Post Closure	Director	25,000

Nº.	Aspect	Potential Impact	Mitigation/Enhancement Measures	Frequency of monitoring	Performance Indicator	Time Frame	Responsible Entity	Cost in USD
			across the site, after which, the site shall be revegetated with indigenous grasses and trees.					
5	Aesthetics		Dispose of all materials and equipment that cannot be reused recycled or sold shall be disposed of at an approved non-hazardous disposal site.	Quarterly	Good aesthetics properties	Post Closure	Department of Fisheries, ZEMA	25,000
6			Re-profile all ponds and drainage channels with additional soil amendment material such as rock from elsewhere, previously stripped topsoil and organic matter and re-vegetated	Quarterly	Re profiling of project area.	Post Closure	Department of Fisheries, ZEMA	15,000
7		Ensure that the final landform is hydrologically compatible with surrounding areas	Carry out re-shaping and grading of the site to make slopes stable and less prominent.	Quarterly	Project area rehabilitated	Post Closure	Department of Fisheries, ZEMA	20,000

Nº.	Aspect	Potential Impact	Mitigation/Enhancement Measures	Frequency of monitoring	Performance Indicator	Time Frame	Responsible Entity	Cost in USD
8	Surface water	Discharge of green water from the pond may contaminate surface watercourses.	Green water will be not be allowed to dry in the pond but will be used in re-vegetation activities	Quarterly	Quality of surface water at closure	Post Closure	Department of Fisheries, ZEMA, District Environmental Officer	15,000
9	Air Quality	Localised deteriorations in the air quality from dust generated from open areas.	Water will be used to suppress the dust and encourage natural colonisation.	Weekly	Amount of dust, g/l, in ambient air within accepted limits.	Post Closure	Department of Fisheries, ZEMA, District Environmental Officer.	5,000
10	Public Health and Safety	Un buried ponds will cause a physical and health hazard to the community	The ponds will be buried so that they will not be a breeding ground for mosquitoes.	Quarterly	No. of disease incidences related to sanitation reduced	Post Closure	Department of Fisheries, ZEMA, District Environmental Officer	20,000
11	Surface Water	Contamination of surface water from storm water contaminated by ponds material	Surface runoff around the ponds facility will be collected in perimeter drains and settled in a settlement pond.	Quarterly	Quality of surface water	Post Closure	Department of Fisheries, ZEMA, District Environmental Officer	20,000
12	Air Quality	Local contamination from wind erosion on exposed surfaces of the	The surrounding vegetation will be maintained to act as a wind shield	Annually	Area of intact vegetation at closure	Post Closure	Department of Fisheries, ZEMA, District Environmental Officer	20,000

N°.	Aspect	Potential Impact	Mitigation/Enhancement Measures	Frequency of monitoring	Performance Indicator	Time Frame	Responsible Entity	Cost in USD
		project area						

Table 18: Environmental and Social Management Plan for Access Feeder Roads Rehabilitation

Aspect	Impact	Mitigation Measures	Frequency of monitoring	Monitoring indicators	Performance Indicator	Time Frame	Responsibility	Cost
Vegetation loss	Site clearance and preparatory works	Vegetation clearance and excavation works should be limited to the area that have been earmarked for roads construction; and Progressive re-vegetation will be implemented through measures such as grass and trees planting.	Weekly	Measures for protection of vegetation in place in the project.	Excavations restricted to required areas.	Construction Phase	Site Manager, District Environment Officer, Project Engineers	20,000
Soil disturbance and erosion	Excavations and site clearance preparatory works.	Delineate site for the works; Limit clearance to only sites/sections where works will be undertaken; Have in place, appropriate storm water drainage infrastructures for efficient discharge of storm water run-off.	Weekly	Presences of drainage channels on site. Heaping of loose soil on site. Loose soil haulage trucks covered with tarpaulin.	No sign of soil Solid	Construction Phase	Site Manager, District Environment Officer, Project Engineers	20,000
Dust nuisance	Equipment operations, haulage fleet movements along the project roads and access roads to campsites and borrow pit sites.	Personal protective equipment (PPE) such as dust masks must be worn in the immediate vicinity of the operations; All machinery and equipment should be	Weekly	Dust accumulation on building roofs and vegetation adjacent to the site; and Use of PPE	No dust Nuisance	Construction	Site Manager, District Environment Officer, Project Engineers	50,000

Aspect	Impact	Mitigation Measures	Frequency of monitoring	Monitoring indicators	Performance Indicator	Time Frame	Responsibility	Cost
		maintained in good working order to ensure minimum emissions including carbon monoxide, oxides of Nitrogen and Sulphur, as well as suspended particulate matter; and Undertake water sprinkling along the project roads, access roads to auxiliary facilities and material stockpiling areas.		for protection against dust during project activities				
Occupational Safety and Health Risk	Dust, noise, emissions, running equipment, vibrations	Training for machinery and equipment operators on safety procedures and precautions; Provide appropriate PPE to all workers and ensure that these are used correctly and at all times; and Hire site HSE officers to regularly undertake safety inspections and trainings for the project activities.	Weekly	Records of accidents and injuries on the site. Training records for site workers in ensuring their safety. Presence of First Aid kits or onsite clinic with qualified medical personnel Workers with PPEs on site.	No occupational safety and health accident recorded.	construction	Site Manager, Project Engineers Department of Fisheries	20,000

Aspect	Impact	Mitigation Measures	Frequency of monitoring	Monitoring indicators	Performance Indicator	Time Frame	Responsibility	Cost
Contamination of surface soil	Oil/fuel spillage	Good housekeeping at all times such as separating used oil/grease containers, cleaning up of leaks and spills and proper disposal of waste oils. Maintenance works for project equipment should be done in a designated mechanical workshop with provisions for oil containment. Install a three-chamber oil interceptor for appropriate management of oil/fuel spillage at the maintenance workshop and parking yard.	Daily	Presence of oil/fuel spills at the site. Poorly disposed oil contaminated wastes. Absence of oil spills	No contamination soil.	Construction Phase	Contractors Site HSE Officer	40,000
Impacts on landscape and aesthetics	Vegetation clearance	Limit tree felling and vegetation clearance within the earmarked road dimensions. Improve the sites aesthetics on completion of site preparation works by landscaping and greening of open areas. Cordon off the	Daily	Planted trees on road reserves of the project roads Presence of a perimeter wall fence cordoning off the site especially for	Minimum impact on aesthetics	Construction phase	Contractors	30,000

Aspect	Impact	Mitigation Measures	Frequency of monitoring	Monitoring indicators	Performance Indicator	Time Frame	Responsibility	Cost
		auxiliary facilities such as campsites with standard height perimeter fences.		auxiliary facilities.				
Noise and vibration	Equipment operations	Heavy-duty equipment used should be insulated or placed in enclosures to minimize noise levels; and Maintain plant/machinery and haulage fleet in good working order; Ensure appropriate manufacturer silencers and baffles are fitted for the specific plant machinery where possible; Vehicle speed restrictions; Restrict working hours from 7am to 6pm. Switch of all project machinery when not in use;	Daily	Complaints from workers and people in the neighbourhood about excessive noise reduced. No excessive much noise being generated from the site. Presence of PPE for noise reduction Noisy equipment Reduced noise levels.	Normal noise and vibration levels.	Construction phase	Site Manager Kasempa Town Council	30,000
Solid waste management	Road construction and auxiliary facilities activities	Procure and have in place waste coded bins for the different types of wastes generated (food stuffs, paper, and glass among others);	Daily	Littered site and access roads Presence of piled waste at the proposed	Presence of coded bins	Construction	Site Manager Kasempa Town Council	20,000

Aspect	Impact	Mitigation Measures	Frequency of monitoring	Monitoring indicators	Performance Indicator	Time Frame	Responsibility	Cost
		Domestic solid waste to be stored in refuse bins temporarily before being taken away for proper disposal by ZEMA licensed waste management firms; The Contractors should institute a waste management plan. This should include distribution and supply of rubbish bins to different sections of the sites; A well-gazetted central waste collection point should be mapped to ease waste collection		sites. Presence of labelled dust bins at the site. Records of waste management and disposal certificates				
Ground water/ surface water pollution	Oil leak and spillages from boats, machinery and equipment. Human waste of people working Workers to sensitise on good hygienic behaviour	Sanitary facilities must be kept clean at all times through regular cleaning and disinfecting. Undertake regular monitoring of the sewage system (sanitary facilities) for any remedial and emergency action. Ensure containment of hazardous substances at	Daily	Records of oil/fuel spillage Registered complaints from neighbouring communities. Reports of untreated effluent discharge into the	No contamination of surface and ground water	Construction phase	Site Manager Kasempa Town Council, Project Engineer	35,000

Aspect	Impact	Mitigation Measures	Frequency of monitoring	Monitoring indicators	Performance Indicator	Time Frame	Responsibility	Cost
		the source of waste generation especially during maintenance. Maintain project equipment in good working conditions		environment especially surface water sources				
Traffic management issues.	Increased traffic volumes	Install warning signage e.g. speed limits, diversions and children crossing; Restrict access to site between 7am and 5pm; and Ensure optimum loading capacity to save on unnecessary trips of heavy loading vehicles.	Daily	Only trained drivers allowed to drive company trucks and machinery. Presence of road sign posts cautioning other road users of a construction site or turn off. Trucks in good working conditions. Incidences of accidents. Availability of traffic guides on junctions and corners.	No traffic related accidents	Construction phase	Site Manager Kasempa Town Council, Project Engineer	20,000

Aspect	Impact	Mitigation Measures	Frequency of monitoring	Monitoring indicators	Performance Indicator	Time Frame	Responsibility	Cost
Fumes emissions	Operation of equipment	Maintain plant machinery in good working order Ensure appropriate manufacturer catalytic converters are fitted for the specific plant machinery; Enforce vehicle speed restrictions; Switch of all project machinery when not in use; and Ensure that all project machinery is serviced on a regular basis.	Weekly	Polluted environment Records of complaints of gaseous emissions, dust and particulate matter from neighbours. Proof of use of personal protective wear by all workers. Equipment Maintenance logs.	No fumes or exhaust emission	Construction phase	Site Manager Kasempa Town Council, Project Engineer	40,000

Table 19: Environmental and Social Management Plan for Construction of Kivuku Service Centre, ZAEDP

Environmental Impact	Mitigation measures	Responsibility	Monitoring Measures	Cost (USD.)
Commissioning of the Construction Works	Site hand-over and ground breaking	Project Team (Lead consultant/ Architect, Contractor Proponent)	Presence of the Project Team	Part of/covered in the project cost
Securing the construction site	Construction of temporary enclosure of galvanized sheets and site hoarding.	Contractor	Presence of perimeter/hoarding fence	Part of/covered in the project cost
Housing for Construction /site Staff	Local labour to be recruited from the settings to avoid need for camp site.	Contractor	Labour recruited from within as per records.	Part of project cost
Site clearance works	Planting ornamental trees and lawn grass.	Proponent/Contractor	Areas planted with vegetation Number of trees planted.	3,500
Security for construction material	Security measures instituted in the site in terms of: a. Fencing/hoarding, b. Controlled entry and exit.	Contractor	Presence of site stores Security personnel in place.	Part of project costs
Extraction and use of building materials	a. Availability and sustainability of the extraction sites; b. Full restoration of the sites after works.	Contractor/Proponent/Project Management Team	Material site rehabilitated	Part of/covered in the project cost
Disturbance of traffic flow during construction	a. Proper signage, b. Awareness creation, c. Education to truck drivers	Contractor/Project team and public	a. Presence of site Notice to direct traffic; b. Presence of flag-persons to control traffic; and c. Presence of warning signs.	Part of/covered in the project cost.
Soil excavation	a. Excavate only areas to	Contractor	Landscaping after	Part of/covered in the

Environmental Impact	Mitigation measures	Responsibility	Monitoring Measures	Cost (USD.)
leading to site disturbance	<ul style="list-style-type: none"> be affected by buildings; b. Dumping of excess excavated materials to sites designated by ZEMA; and c. Restoration of sites excavated. 		completion of construction	project cost.
Soil erosion	<ul style="list-style-type: none"> a. Create and maintain soil traps and embankments; and b. Landscaping after completion of construction. 	Contractor/proponent	Lack/absence of soil	8,500
Noise Pollution and Vibration	<ul style="list-style-type: none"> a. Ensure use of serviced and greased equipment b. Switch off engines not in use c. Construction work to be confined to between 8am to 5pm d. use of earmuffs by machine operators 	Proponent and contractor	Part of Routine/operation procedure	Lack of complaints
Air Quality	<ul style="list-style-type: none"> a. Water sprinkling to reduce dust emission during construction b. Ensure servicing of vehicles regularly 	Proponent and contractor	Part of Routine/operation procedure	5,000

Environmental Impact	Mitigation measures	Responsibility	Monitoring Measures	Cost (USD.)
Risks of Accidents and Injuries to Workers	<ul style="list-style-type: none"> a. Provide First Aid Kits on site, b. Education and awareness to all construction workers b. Ensure use of appropriate personal protective clothing a. Provide First Aid Kits on site b. Ensuring Building Strength and stability c. Proper supervision 	Proponent/contractor	<ul style="list-style-type: none"> a. Presence of well equipped First Aid kit; b. Presence of security Guards on site; and c. Presence of a register for visitors on the site. 	25,000
Health and Safety	<ul style="list-style-type: none"> a. Proper signage and warning to public of heavy vehicle turning, b. Ensuring Building Strength and stability, c. Provide clean water and food to the workers, d. The contractor to abide by all construction conditions especially on health and as well as welfare of the workforce. 	Proponent/contractor	Part of Routine/operation procedure.	15,000

Environmental Impact	Mitigation measures	Responsibility	Monitoring Measures	Cost (USD.)
Solid waste generation and management	<ul style="list-style-type: none"> a. Establish a collective waste disposal and management system; b. Provide waste disposal bins on each of the floors and they should be well protected from adverse weather and animals; c. Ensure waste materials are disposed of on sites approved by the Resident Engineer and Kasempa local government; a. Ensure re-use of materials that can be re-used; and d. Use of the 3rs—Reduce, Re-use, Re-cycle. 	Proponent/contractor	<ul style="list-style-type: none"> a. Absence of solid waste on the site; b. Waste handler in place. 	25,000
Water abuse	The Developer to post wise water use messages around water taps inside the building.	Proponent	Messages to conserve water posted around water taps.	Part of operations costs.
Liquid Waste Generation and Management	Regular inspection and maintenance of the waste disposal systems during the operation phase and connection to the sewer	Proponent/Estate Managers	Conventional sewer line and or septic tank. Presence of waste handling bins. Absence of wastes.	Part of operations budget for the Facility.

Environmental Impact	Mitigation measures	Responsibility	Monitoring Measures	Cost (USD.)
Storm Water impacts	<ul style="list-style-type: none"> a. Provide roof gutters to collect and direct roof water to tanks and the overflow to the drains; a. Construct drains to standard specifications; b. Develop a storm water drainage system and 	Proponent Contractor	Storm water discharge infrastructure in place (channels, water harvesting facilities in place).	Part of the project cost
<ul style="list-style-type: none"> a. Disruption of existing b. natural environment and modification of micro- climate: c. Increased development density; d. Increased glare/solar reflection; e. Reduced natural ground cover/surface run-off; f. Obstruction of 	<ul style="list-style-type: none"> a. Development to follow approved building line, plot coverage and plot ratio. b. Careful layout and orientation of buildings to respect wind and sun direction. c. Adequate provision of green and open space planted with grass, and ornamental plants. 	<ul style="list-style-type: none"> a. Project team (contractor b. Proponent, architect or Supervising Consultant, etc.) 	Lay-out of the building; Approval plans from Kasempa Local Government Authorities in place.	Part of /covered by the project cost
Decommissioning phase				
Building Safety	<ul style="list-style-type: none"> a. Assess the condition of buildings to ascertain 	Engineer/Proponent	Engineer and Tests on the building	Engineer and Tests on the building
Land and building use	<ul style="list-style-type: none"> a. Ascertain the Planning development policy 	Kasempa district Physical Planner	Consultants present	Consultants present
Accidents/injuries	Securing the Site by fencing off	Contractor/Proponent	Presence of perimeter fence	Part of project costs

Un-disconnected services e.g. power, water, telephone, sewer etc	<ul style="list-style-type: none"> a. Ensure disconnection of all services. b. Remove all surface and underground cables and 	Contractor	Absence of cabling	Absence of cabling
Solid waste generation (demolition waste)	<ul style="list-style-type: none"> a. Ensure waste materials are disposed of on council and ZEMA approved sites. b. Ensure re-use of materials that can be re-used. c. Use of the 3rs – Reduce, Re-use, Re-cycle. 	Proponent/Contractor	Absence of Debris	Absence of Debris
Noise and Vibration	<ul style="list-style-type: none"> a. Ensure use of serviced equipment b. Switch off engines not in use c. Demolition work to be confined to between 8am to 5pm; 	Proponent/Contractor	Lack of complaints from the neighbours	Part of project management and operations costs
TOTAL				82,500

8.2 ENVIRONMENTAL MONITORING PLAN

Department of Fisheries will implement an environmental monitoring plan in and around the project site partly to uphold sound environmental practice but also to comply with the requirements of the Environmental Management Act (Act N^o. 12 of 2011). The environmental monitoring will include the following:

- a. Effluent;
- b. Water Quality (Ground and Surface Water);
- c. Weather.; and
- d. Fish diseases.

8.2.1 EFFLUENT, GROUND WATER AND SURFACE WATER

Discharge of effluent is expected from the washings from the processing unit and ponds into the sedimentation pond. The green water will not be discharged directly into the open environment but will be treated before discharge. The discharged water will comply with the Zambian discharge specifications of effluent. The objective of the effluent monitoring will be:

- to record the volume of effluent being discharged into the environment;
- to monitor and record the quality of effluent being discharge to the environment; and
- to monitor compliance with effluent standards and permit limits.

Analytical parameters

The following parameters will be monitored: volume, Electrical Conductivity, TDS, BOD, COD, and turbidity, pH, Total Coliforms, phosphates and nitrates.

Frequency

Monitoring of the above parameters will be on a monthly basis. The results of this monitoring will be submitted to ZEMA on a bi-annual basis. The sampling frequency may be reviewed depending on the results of the sampling campaign.

Quality Assurance / Quality Control Analysis

A reputable analytical laboratory will be used to analyse for all of the parameters specified above. The sampling protocol QA/QC will include duplicate and spiked samples. In addition, some samples will be sent to an independent accredited laboratory for independent analysis.

8.2.2 WEATHER

Meteorological data on virtually all weather variables will be obtained. Examples are: wind direction and speed, sunshine, rainfall, humidity, temperature, barometric pressure, rainfall data, solar radiation and evapo-transpiration, time and date of highs/lows. This information is an important input in relation to environmental management planning. For instance, rainfall data, gathered over a period of time, will be used to predict storm events and can therefore assist in storm water management. The data will also be used to develop a site water balance and water resources management plan.

8.2.3 MONITORING FISH DISEASES

While precautions measure in this document will be taken to prevent diseases, close monitoring of disease is equally important. This will be an effective way to detect sick fish and identify the cause

of disease at an early stage, so that appropriate treatment can be given and transmittable fish disease can be controlled. The fish health inspection programme will include:

8.2.4 FULL PHYSICAL EXAMINATION

Department of Fisheries will carry out the following simple health inspection routine daily:

Feed intake Reduced

Feed intake is the first sign of many fish diseases. Department of Fisheries will therefore keep daily feeding records to ensure they have sufficient information to compare general intake trends.

Abnormal swimming patterns

Examples are fish lying flat, rubbing against the bottom or, jumping out of the water, circling in water or losing buoyancy balance. All these may be signs of disease. If disease symptoms are detected, appropriate treatment will be carried out.

8.2.5 DETAILED HEALTH INSPECTION

This will be carried out if abnormal behaviour is not connected with environmental factors and will include checking the body surface, fins and gills, and see if there are any surface parasites. Detailed health inspection will include checking the body surface and fins. This is because body surface and fin wounds are obvious signs of infections. Common body symptoms of fish diseases are: Dark body tone, Ulcer Tumour, haemorrhage and tail-rot, loss of scales, protruding eyes, and oedema. The gills will also be checked and if the gills are whitened or show ulcers or with deep red spots, or there are gill flukes, excessive mucus or obstructive substances, the fish may be infected and gill functions may be impaired. Besides the above measures, The Department of Fisheries will carry out:

- a Testing for bacteria, parasites and viruses; and
- b On-site and laboratory assessment of water quality test.

Table 20: Environmental Monitoring Plan

What needs to be managed	Objective to address impact	Measures to be taken	Monitoring Indicators	Responsibility	Frequency	cost
General	To ensure that the project operations adhere to the EMP and comply with statutory requirements	Routine inspections and testing, routine environmental records, annual audits and incident reporting will be done	No. of inspections; No. of reports prepared.	Department of Fisheries	Quarterly	20,000
Wastewater quality	To minimise the impact of discharged effluent from the settling pond on the aquatic environment	Wastewater quality analysis from effluent to assess potential impacts on the environment	No. of samples taken. Quality of discharged water	Department of Fisheries	Monthly	30,000
Ground water quality	To avoid or minimize contamination of ground water from point or diffused sources	Ground water quality analysis from boreholes on site will be monitored routinely to assess potential impacts on the aquifer	No. of ground water samples taken. Level of ground water quality	Department of Fisheries	Quarterly	25,000
Meteorological data	To use weather data for forecasting unfavourable weather patterns	Collect weather data from the weather station and record in a database	Recorded weather variables	Department of Fisheries	Daily	15,000
Occupational health and safety	To minimize risks to occupational health	All work areas will be inspected frequently and safety inspection tours will be conducted to ensure that all aspects of health and safety are being observed	No. of safety Inspections conducted.	Department of Fisheries	Daily	15,000
		Produce risk assessment reports for appropriate action to be taken	No. of Risk Assessment reports produced	Department of Fisheries	Monthly	10,00

		Undertake a health and safety audit to assess the effectiveness of the health and safety plan, and also to enable continual improvement in the management of health and safety at the project site.	No. of Accidents/incidents recorded.	Department of Fisheries	Monthly	20,000
	To minimize risks to occupational health	Keep maintenance records for all firefighting equipment	Records of maintenance	Department of Fisheries	Annually	2,000
Fish diseases	To identify and prevent the spread of fish diseases to other parts of the farm as well as other farms on the lake	Undertake fish health inspection programme to include: Feed intake Reduced Abnormal swimming patterns Detailed health inspection to include checking the body surface and fins. Testing for bacteria, parasites and viruses; On-site and laboratory assessment of water quality test	No of fish diseases identified and Recorded. Frequency and occurrence of the fish diseases. Mortalities recorded	Veterinarian	Daily	
Public health	To minimize risks of diseases	Waste management facilities will be inspected regularly Fish mortalities will be used for the production of crocodile feed.	No. of diseases recorded.	Veterinarian	Daily	
Post assessment environmental audit	To ensure that the approval conditions attached to the ZEMA decision conditions are complied with.	Undertake an environmental audit of the project site within a period of not more than thirty six months after approval	Audit report	Department of Fisheries	Within thirty six months after approval	

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

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.

9.3 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.

9.1.1.5 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.

9.4 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.

9.5 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.

9.6 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.

9.7 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.

9.8 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 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions can be drawn from the project:

- a. While it is now recognized that, outputs in capture fisheries and small-scale aquaculture are increasingly stagnating, commercial aquaculture holds promising potential to help increase the availability and accessibility of fish in the country, especially for the rural poor in Zambia;
- b. It is also noted that, lately, fish is becoming significantly less accessible especially for the lower income populations when market prices are beyond their means and indications are that, the nutritional status of such people is worsening with alternate sources of animal proteins is declining;
- c. Based on the trends of population increase, annual fish demand is projected to be at least 40% above the current unsatisfactory fish consumption levels. In view of these, and in order to attain national self-sufficiency in fish protein requirements in Zambia, an important alternate source of fish production is increasingly recognized to be fish farming hence, importance of this project in socio-economic development of the country; and
- d. However, implementation of the proposed Project will likely trigger a number of environmental and social concerns which have been assessed in this study likely to be largely localized, of short-term nature, medium scale and can be addressed through implementation of the ESMP which is expected to ensure compliance and sustainability. Therefore, the proposed ZAED Project is recommended for consideration and approval.

11 DECLARATION OF AUTHENTICITY OF REPORT CONTENTS

We do hereby declare that the information presented herein regarding the Environmental Project Brief Report for the proposed Aquaculture Park and Infrastructure Development in Kasempa 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

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13 APPENDICES

13.1 APPENDIX 01: EMERGENCY RESPONSE PLAN

13.1.1 EMERGENCY RESPONSE PLAN

The Aquaculture Emergency Response Guidance aims to help to save the lives and livelihoods of people in the aquaculture sector who may be affected by disasters and humanitarian emergencies. It aims to do this by improving the quality of the design, implementation and assessment of interventions in aquaculture in the wake of disasters. It draws on best practice and experience in responding to disasters that have affected fisheries and aquaculture and in supporting people working in the sector to rebuild their livelihoods.

13.1.2 STEPS FOR EFFECTIVE CONTROL OF HAZARDS IN AQUACULTURE PARK OPERATIONS

The following steps are a practical and effective way of controlling hazards:

13.1.3 STEP 1: IDENTIFY THE HAZARD

All tasks, equipment and substances should be examined and when listing hazards use:

- a. Information from past incidents and workplace injuries;
- b. Information from fishermen, workers, marine's units in Zambian Army and police establishments;
- c. Best industry practices;
- d. Sight, smell, touch and hearing senses; and
- e. Close examination of areas or activities where children or visitors may be present.
- f. Operators of Aquaculture Parks ought to obtain and read the manuals and safety sheets that are provided by equipment, machinery, and chemical manufacturers. They also need to develop and implement communication and emergency plans to allow for a timely response in the event of an incident.

13.1.4 STEP 2: ASSESS THE RISK

Risk is the chance that an existing hazard may actually cause harm or injury. Aquaculture Parks business will have potential hazards that could impact the health and safety of its workers. As such, its workers need to make sure they adhere to safe workplace health and safety regulations, providing appropriate and adequate supervision and ensuring that all workers have the necessary training and equipment to do their jobs safely. If a hazard has been identified, assess the risk by examining;

- a. The *likelihood* of the hazard resulting in injury to the crew or other persons - is it likely or unlikely to occur?
- b. The *likelihood* of the hazard resulting in damage to the boat or equipment, and
- c. The *severity* of the incident - could it cause death, serious injury, or minor injury?

13.1.5 STEP 3: ELIMINATE OR CONTROL THE HAZARD

There are several ways to control a hazard and it is important that, one handle ways which are reasonable and practical for the circumstances at hand such as:

- a. **Eliminate** hazards posed by equipment, animals, and the environment if possible. For example, get rid of faulty machines and equipment;
- b. **Substitute** something safer by using a different machine, material or work practice that poses less risk to perform the same task;
- c. **Use engineering/design controls** when is not possible to eliminate hazards. Engineered controls include machinery guards and PTO shields. Design controls, such as locked fences, isolate the worker from the hazard.
- d. **Protect workers** if other controls are inadequate. Protect workers through training, supervision, and personal protective equipment (PPE). For example, supervise new workers until they are competent to deal with hazardous situations. Use and provide proper clothes and respirator protection for handling dangerous chemicals or biohazards.

13.1.6 DIVING SAFETY

Divers must not dive if they are in any way unfit to do so (e.g., ill, fatigued, impaired, injured, etc.). Weather and water conditions in the area of the planned dive must be considered and diving must be suspended if weather or water conditions are hazardous or likely to become hazardous.

- a. A diver must not be forced to dive or be penalized for not diving if, for valid reasons, he/she decides not to enter the water.
- b. In the event that diving operations are contracted out, the aqua culturist must require that the operation is carried out in compliance with all applicable health and safety regulations.
- c. Divers must not stray from the posted dive site.
- d. Only equipment/vessels that will be used in connection with the dive should be brought within the dive site boundaries.
- e. Divers must be provided with a lamp or other suitable device during periods of darkness.
- f. The dive site or underwater work site must be adequately illuminated if the nature of the dive permits.
- g. Cage guards must be placed on all propellers, or props on boats must be disengaged and locked out while being used as a dive base.
- h. Divers conducting a dive in open water without a lifeline must carry an audio or visual signalling device.
- i. A dive must not occur if a health or safety hazard may be caused by equipment at or near the dive site, unless the divers are protected from the hazard.

13.1.7 FIRE SAFETY PREVENTION

Fires and explosions on the aquaculture farm can be caused by a number of things including fuels, faulty wiring, overheating equipment and welding. Unfortunately, fires can also occur on the aquaculture boat when it is working the lease. These hazards can cause damage to buildings, equipment and machinery as well as serious injury or death.

13.1.8 COMMON HAZARDS

Common fire hazards found on aquaculture operations include:

- a. Improper storage of flammable and combustible materials.
- b. Faulty/damaged electrical wiring (coating on wires are susceptible to salt water and can corrode or rot over time).
- c. Malfunctioning or overheating equipment/machinery.
- d. Sparks from welding.
- e. Smoking around flammable/combustible materials.
- f. Overloaded outlets.
- g. Ruptured fuel line.
- h. Improper refuelling of boats.
- i. Improper ventilation of enclosed spaces that contain fuel (e.g., bilge or gas storage areas).
- j. Leaking propane or oxygen tanks.
- k. Improper storage of oily rags.

13.1.9 SAFE PROCEDURE

Develop and train workers on the emergency plan for responding to fires.

- a. Emergency numbers and civic address of the property should be posted by all telephones.
- b. Inspect all electrical systems annually (more regularly if suggested by the manufacturer or you experience problems with flickering lights, disruptions of power, etc.).
- c. Never overload an outlet or a circuit.
- d. Keep extension cords in good repair.
- e. Protect light bulbs and heat lamps with a wire cage.

13.1.10 STORAGE OF FLAMMABLES/COMBUSTIBLES

Store all flammable and combustible materials away from oxygen tanks and sources of heat (e.g., open flames, engines, equipment, daylight).

- a. Give consideration to the fire characteristics of all flammable and combustible materials prior to storage, handling and piling.
- b. Store fuel in labelled containers. Store flammable products in their original containers.

13.1.11 FIRE PREVENTION IN STORAGE

- a. Pile flammable/combustible materials in a manner that will not obstruct exits, will minimize the potential for (or spread of) fire, and will permit convenient access for firefighting.
- b. Limit the flammable or combustible materials that you keep on board the boat to those that are necessary for the daily maintenance and operation of the boat.
- c. Carry out work requiring the use of flammable materials in a well-ventilated area away from any materials that could be ignited by a spark.
- d. Never pour gas from a gas container with a spout into a running or hot pump/motor.
- e. Implement a “no smoking” policy around machinery operation, fuel or flammable products storage areas, and fuelling stations.

f.

13.1.12 FIRE PREVENTION ON BOATS/VESSELS

- a. Each vessel must have the appropriate sized fire extinguishers.
- b. Fire extinguishers must be kept fully charged and be renewed as specified by the manufacturer.
- c. Keep bilges clean and free from oil and fuel. Keep the bilge pump in good working order.
- d. Provide the appropriate ventilation and exhaust for boats and machinery in enclosed areas.
- e. Properly store and maintain batteries.
- f. Properly lubricate and adjust machinery to minimize friction.

13.1.13 REFUELLING SAFETY PRECAUTIONS

- a. Moor the boat securely.
- b. Shut off engines; make sure all passengers are ashore.
- c. Don't smoke and extinguish all open flames; close all windows and hatches.
- d. Take portable tanks ashore.
- e. Don't use electrical switches.
- f. Wipe up any spillage; turn on blower for at least five minutes.
- g. Check for vapours odours.

13.2 APPENDIX 02: OCCUPATIONAL HEALTH AND SAFETY CODE OF PRACTICE IN AQUACULTURE

The purpose of the Aquaculture Occupational Health and Safety Code of Practice is to allow Aquaculture Parks developers and their workers to work together to identify and control situations or hazards that could cause harm. Aquaculture Park owners must take seriously their responsibility to ensure a safe and healthy workplace. The loss of workers due to accident and injury can pose serious downtime, require training of new and in-experienced workers, increase Workers Compensation rates and pose legal liabilities. While the presence of a well thought-out risk management strategy might not prevent all accidents from occurring, it will assist in the demonstration of due diligence. This Code of Practice is not meant to be a definitive document of Aquaculture Parks safe work practices, but rather, one of many awareness tools that is available to employers and workers interested in maintaining a safe and healthy workplace.

13.2.1 EMPLOYERS' RESPONSIBILITIES

Employers are responsible to take every reasonable precaution to protect the health and safety of their workers and any person on or near the workplace. Employers must also:

- a. Provide and maintain machinery, equipment and materials in a safe condition;
- b. Provide adequate information, instruction and training to enable safe working
- c. Ensure workers are adequately supervised;
- d. Ensure workers are familiar with the task at hand;
- e. Ensure workers are familiar with the proper use of all personal protective equipment and devices (e.g. guarding) required for their health and safety; and
- f. Consult with workers on health and safety matters.

Employers must also post in a prominent place the following information;

- a. A current copy of the Occupational Health & Safety Act and Regulations,
- b. Any relevant Code of Practice,
- c. All information and reports recommended by an Occupational Health and Safety Officer.
- d. All chemicals in the workplace. Employers must prepare a list of all chemical substances in the workplace which may be a hazard to the health or safety of the workers

13.2.2 WORKERS' RESPONSIBILITIES

Workers (including independent Contractors) must take reasonable care to protect their own safety and health, as well as that of others on or near the aquaculture operation. To ensure health and safety, workers must:

- a. Cooperate with their employer and use all protective devices, equipment and clothing required by the employer;
- b. Consult and cooperate with the employer and other workers on workplace health and safety issues;
- c. Comply with the Occupational Health and Safety Act;
- d. Cooperate with any Occupational Health and Safety officials; and
- e. Report any potential workplace hazards or dangers to a supervisor.

13.2.3 REPORTING OF SERIOUS WORKPLACE INJURIES OR FATALITIES

Employers shall ensure that all critical injuries are immediately reported to the Manager, Occupational Health and Safety or to the Health and Safety Representative in the workplace within 24 hours of the serious workplace injury. It is an offence to disturb the scene of a serious workplace incident except to attend to injured workers or to prevent further injury or damage to property until Occupational Health and Safety Officers have completed their investigation of the serious workplace injury. Serious workplace injuries and fatalities must be reported when a worker is critically injured in a manner which:

- a. Causes or may cause a fatality
- b. Produces unconsciousness
- c. Results in substantial loss of blood
- d. Involves a fracture
- e. Causes an amputation of an arm, leg, hand or foot
- f. Causes burns to a major portion of the body or
- g. Causes the loss of sight in one eye

13.2.4 DEVELOPING A HEALTH AND SAFETY PLAN

A safe workplace is created when everyone takes a role in managing health and safety issues. A good safety management program can help avoid incidents that are costly, time consuming and stressful for everyone involved. A health and safety plan should be developed to ensure that every reasonable step was taken to prevent an incident from occurring. Health and safety plans can be used to prove due diligence in legal matters.

Due diligence means, anyone with responsibilities for health and safety takes all reasonable steps to prevent incidents or injuries from occurring. A good health and safety plan should include:

- a. A method of identifying hazards
- b. Safe work procedures
- c. A program for training workers in safe work procedures
- d. A method of monitoring workers for safe work procedures
- e. A progressive disciplinary policy to ensure compliance with safety policies.
- f. Documentation of the steps of the health and safety plan as proof of due diligence
- g. When developing a health and safety plan, one place to begin is to assess the safety issues of the workplace.

13.2.5 IDENTIFY HAZARDS AND THE ASSOCIATED RISKS

Job tasks which involve hazards that could cause physical harm need to be examined. The following information will assist in identifying the hazards and putting procedures in place to deal with the associated risks on an aquaculture operation. A hazard is any situation, activity, procedure, piece of equipment/machinery or fish that may cause harm or injury to a person. Some of the common hazards that are typical of aquaculture ponds operations include:

- a. work environment (weather, heat, cold, sun);
- b. machinery and equipment (hydraulics, boat stability);
- c. diving
- d. fish handling (needle-stick injuries, cuts)
- e. workplace layout (ladders, decks)
- f. Combustible materials.

13.2.6 FIRST AID AND EMERGENCIES

- a. It is basic; the boats operations will require operators to have Emergency First Aid Certificate. There has to be a First Aid Kit.
- b. The operators must have this appropriate level of First Aid training from a recognized training agency.
- c. Clearly mark the First Aid kits and store them in an accessible area. Workers must know where all First Aid kits are located.
- d. Keep the First Aid kit(s) current by making sure that the contents have not passed their expiry date and that replacements have been added to the kit after use.
- e. Transportation must be available at all times to transport an injured worker to a nearby medical facility.
- f. A means of communication must be available to workers working in isolated locations (i.e., far off-shore in the lake in Aquaculture Parks).
- g. Keep the required distress, boat safety and emergency equipment in a dry, easily accessible area.
- H. Keep a record of all injuries and note any First Aid that was administered.

13.3 APPENDIX 03: RECORDS OF MEETINGS HELD AT MPUNGU AND KAKOMBE SITES IN KASEMPA ON 11TH OCTOBER 2019

The meeting was called to order at 14:41 hours by the Assistant Officer – Fisheries Department, by welcoming every community member present and thanked them for making time to attend the meeting despite the short notice. A prayer was offered by one of the community members. After the prayer, the meeting proceeded with introductions of everyone present. The Consultants were called upon to explain their mission and what was expected. After the presentation which involved the project itself, its components and expected project deliverables, concerns and comments were invited from the community. These were received with responses given as indicated in table below. There being no other issues to discuss, the meeting was closed with the prayer at 16:36 hours.

Concerns and Responses

Table 21: Site Meeting Minutes

Name	Concern/Comments	Response
Mekeson Kanyakumari	Requested that there was need for the government to provide assistance in feeding their children.	The project was an empowerment programme that once implemented, would see the community becoming self-sustaining.
Febby Kafuma	Requested that the project should endeavour to promote constant engagement between the Fisheries Department and the community. More training was equally required in fish farming and on the means of maintaining the facilities. She also wanted to find out whether the project would provide fish feed which has proved to be a challenge considering that the current stock of fish in the existing ponds are stunted because there has been no fish feed. Considering the project might impact on the water quality which is also the source for drinking water for the community, she wanted to find out what mitigation measures that the project will put in place.	The concern on the constant visitation and training by the Government was taken not and would be escalated to relevant offices. On the aspect of the water quality which is likely to be impacted through the feed for the fish, part of the mitigation measures would be constant water quality sampling and also provision of alternative water sources for domestic water supply.
Gabriel KanyetaLweleka	Raised a concern that the current stock in the existing fish ponds had over stayed (8-9 years) and needed restocking. He wanted to find out if new stock will be brought in. Another concern raised was the issue of transporting the fish and marketing issues. The community	The project had the component of fish restocking. Ideally, with increased fish production increasing, aspects of markets and transport will fall in place.

	was facing transport challenges from their community to town in order to sale their fish. He wanted to find out how the project would assist in this regard.	
Festus Matafwali	Raised a concern that none of the farmers had access to the CEEC loans and wanted to find out how best the community could be assisted to access these loans	The concern which was deemed common in almost all the fishing/project proposed areas was noted and would be escalated to relevant offices.
Jessy Mulowa	Wanted to find out what security measures the project would put in place considering that the project would upgrade their livelihoods and as a consequence theft would be evident	The community was advised to be vigilant and be alert. However, part of mitigation measures would be engaging the community more and mobilizing community watch groups

Table 22: Kasempa–Mpungu and Kakombe Meeting Attendance List

S/ N	FIRST NAME	LAST NAME	ORGANISATION	POSITION	PHONE #	EMAIL
1	Chisha	Chanda	Kaizen	Water Quality Specialist	0977482349	chishachanda@gmail.com
2	Orleans	Mwenya	Kaizen	Mapping Specialist	09648155908	ochishiba@gmail.com3
3	John	Mbala	Department of Fisheries	Assistant Officer	0963925592	Mbalajohn2018@gmail.com
4	Meckson	M	Lwama	Secretary	0950173207	
	Febby	Kafumu	Lwama	Chair Lady	0953798495	
5	Neddy	Muyange	Lwama	Member		
6	Festus	Matafwali	Lwamabembe	Member	0957369410	
7	Kanyeta	Lweleka	Lwamabembe	Member	095679560	
8	Jessy	Mulowa	Lwamabembe	member		
9	Yalukanda		Kakombe		0950812956	
10	Camerin	Munwe	Kakombe		0953798240	
11	Matengo	Nivia	Kakombe		0953797408	
12	Peter	Kayombo	Kakombe		0957572208	
13	Kibale		Kakombe		0950813249	
14	Edward		Kakombe			
15	Angela		Kaminsa		0950173133	

16	James	Kangayi	Naso		0969947740	
17	Maxwell	kayombo				
18	Michelo	Siansase			0954758000	
19	Godfrey	Syabwengu			0954516398	
20	Nelson	Mungala			0955805661	
21	Martin	Chiyaze			0954241333	
22	Maybin	Sinkala				
23	Liberty	Liswaniso	Ministry of Agriculture		0955943643	
24	Kayombo	R			0954556620 2	
25	Sapola	J			0950173440	

13.4 APPENDIX 04: SCANNED ATTENDANCE REGISTER

Zambia Aquaculture Enterprise Development Project Location: Kasempa

Date: 11/10/2019

No	Name	Organisation	Designation	Cell	Email	Signature
①	JOHN MBALA	Fisheries	AQUACULTURE AD	0963925592	mbal.john2009@gmail.com	
②	Museya Chishike	Kaizer	Mapping Specialist	09771-815508	ochishike@gmail.com	
③	Chishachanda	Kaizer	Water Resources Quality Specialist	0977482345	chishachanda@gmail.com	

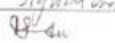
Zambia Aquaculture Enterprise Development Project Location: Kasempa, Mpanga Central

Date: 11/10/2019

No	Name	Organisation	Designation	Cell	Email	Signature
	MECKSON MWAPE	Lusaka F.F	Secretary	0956173207	120095	
	FEBBY KAFUMA	Lwama F.F	Chair lady	0933793495	120095	
	WEDDY MUYANGE	Lwama F.F	member	0957369410	120093	
	FESTUS MATAFWALI	Lwambembe F.F	member	095679560	120093	
	KANYETA MWOLEKA	Lwambembe F.F	member			
	JESSY MUKWATI	Lwambembe F.F	member			
	Febby Kafuma		N.R.C	13053125/1		
	FESTUS matafwali		N.R.C	158697/25/1		
	Lwaleka, Kanyeta		N.R.C	134577/25/1		
	Kanyeta Mwoleka			0950773229	139192/25/1	

Zambia Aquaculture Enterprise Development Project Location: Kasempa

Date: 11th October

Nº	Name	Organisation	Designation	Cell	Email	Signature
1	MR YALUKA ODI	KALOMBE		0950812956		
2	CHRISTINA MUMWE	KALOMBE		0953798240		C. Mumwe
3	MATENGO MUMBI	KALOMBE		0953797608		
4	PETER KALOMBO	KALOMBE		0957572208		
5	KIBALE	KALOMBE		0950813249		
6	Edward	KALOMBE				A. NASO
7	ANGELA	Kaminisa NASO		0950173133		
8	JAMES KANWANI MAX WELI KANE MBO			0969967740		J. Kanwani M. Kanwani

Zambia Aquaculture Enterprise Development Project Location: Kasempa

Date: 11th October 2020

Nº	Name	Organisation	Designation	Cell	Email	Signature
	R. KALOMBO			0954556620		
	J SAPOLA			0950173440		J SAPOLA

13.5 APPENDIX 05: PHOTO REPORT



Figure 5: Meeting with Mr John Mbala, Kasempa Assistant Fisheries Officer



Figure 8: Water sampling at Kivuku Aquaculture project site in Kasempa District



Figure 6: Proposed site for the Aquaculture Project service centre site at Kivuku.



Figure 9: Storage facility structure at Kivuku Aquaculture service centre.



Figure 7: P Proposed site for the Aquaculture Project service centre site at Kivuku



Figure 10: Kivuku service centre project site is right behind the Kivuku health centre.



Figure 11: Proposed project site for the Aquaculture Park at Nkenyauna.



Figure 12: Proposed project site for the Aquaculture Park at Nkenyauna



Figure 13: Existing fish ponds at the Nkenyauna Project site in Kasempa District



Figure 14: Water sampling at Nkenyauna Aquaculture Park in Kasempa District



Figure 15: Storage facility structure at Nkenyauna Aquaculture Park project site



Figure 16: Community meeting with the fish farmers at Mpungu central



Figure 17: Community meeting with the fish farmers of Mpungu central



Figure 18: Community meeting with the fish farmers of Mpungu central



Figure 19: Community meeting with the fish farmers of Nkenyauna central



Figure 20: Community meeting with the fish farmers of Kakombe area



Figure 21: Community meeting with the fish farmers of Kakombe area

13.6 APPENDIX 06: WATER RESULTS



SCHOOL OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT
ENVIRONMENTAL ENGINEERING LABORATORY

P.O Box 32379, Lusaka

PHYSICAL/CHEMICAL EXAMINATION OF WATER

Attn : Kaizen Consulting International
Lusaka
Sampled by : Client
Sampling date : 03.12.2019
Report date : 04.02.2020

Laboratory Results (Kasempa)

Parameter	Mpungu	Kivuku	ZABS Guideline (Maximum Permissible value for drinking water)
pH	7.27	7.77	6.5- 8.0
Conductivity ($\mu\text{s}/\text{cm}$)	530	479	1,500
BOD (as O_2 mg/l)	2	5	-
Turbidity (NTU)	1.75	11.90	5.0
Salinity (ppt)	0.06	0.05	-
Iron (mg/l)	<0.01	<0.01	0.30
Ammonia (as $\text{NH}_4\text{-N}$ mg/l)	<0.01	<0.01	1.50
Chlorides (mg/l)	10.0	15.0	250
Nitrites (as $\text{NO}_2\text{-N}$ mg/l)	<0.001	<0.001	1.0
Nitrates (as $\text{NO}_3\text{-N}$ mg/l)	0.50	0.14	10.0
Phosphorous (mg/l)	<0.01	<0.01	150
Total hardness (as mg CaCO_3 /l)	544	268	500
Calcium (mg/l)	116.0	64.0	200

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

Tested by: E. Mutati
Lab. Technician

Checked by: Joshua Liyungu
Lab. Manager

Approved by: Dr. Ian Banda
Co-ordinator



13.7 APPENDIX 07: 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 22: Mr Chishiba – Policy Framework presentation

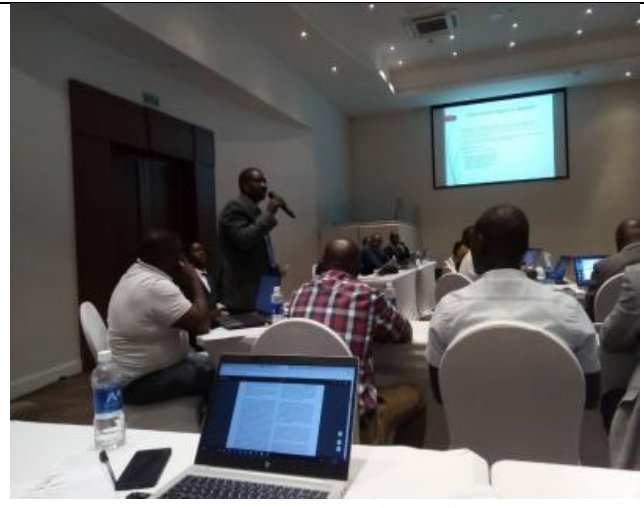


Figure 23: Mr Kalunga - Biological resources presentation



Figure 25: Mr Chanda - Water resources presentation

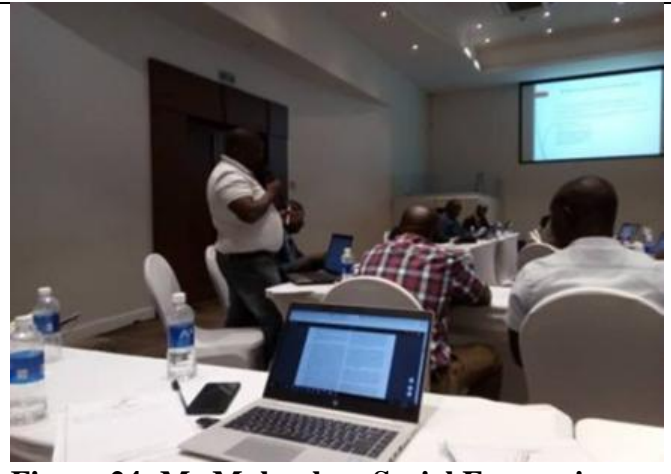


Figure 24: Mr Mulomba - Social Economic presentation

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

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43	FISHE P. MWALE	CHAIR	ADAZ	0977335201	f.mwale@yalfo.com
44	Namachimbwa Chumbwa	FRO	ZAEDP	0977547266	namachimbwa@gmail.com
45	Nelson Chilengi	Admin Assistant	ZAEDP/DOF	0966461611	nnelsonchilengi@gmail.com



HIS ROYAL HIGHNESS SENIOR CHIEF KASEMPA

LUKENA HEADQUARTERS

P.O. BOX 120014 KASEMPA 0953090561/ 0977654850

The Permanent Secretary
Ministry of Agriculture and Livestock
Mulungushi House
P.O Box 50197
Lusaka

Dear Sir,

RE: CONSENT FOR THE ESTABLISHMENT OF AN AQUACULTURE PARK IN KASEMPA DISTRICT

Reference is made to the letter of application for land to establish a land based Aquaculture Park in Kasempa District with Kivuku Government Fish Farm being the Hub by the District Agriculture Coordinator dated 6th February 2015.

I Senior Chief Kasempa, acting within the scope of my authority on Customary land within my Chiefdom, and reference to the Consultative meeting held between the District Agriculture Coordinator's office and Myself held today the on 10th February 2015, I hereby give consent and approval to the Ministry of Agriculture and Livestock to put up an Aquaculture park in the following areas: Sota1, Kamazozo, Sota2, Kalobati, Kamono, Mpungu south, Kamiba, Masango, Lwamabembe, Ndulundulu, Shakwamba, Lubofu, Kabusenga Dam, Kabusenga weir, Kabele, Shibende, Kantenda, Nkenyauna, Njenga and Kivuku. A table showing details is attached to the letter.

The Royal establishment appreciates the Ministry of Agriculture and Livestock's desire to develop the Chiefdom and the District through the establishment of an Aquaculture Park. Further I would like the project to also expand to other areas as follows: Mufwashi, Kafobola, Makuka, Kelongwa, Mitumba, Shivuma, Nsuki, Nyoka, Mbulumunene, Jifumpa, Kamakechi, Shapenda, Kalukundwe and kamatete.

I therefore have no objection to the establishment of land based aqua pack in Kasempa district.

Yours in tradition Leadership


Kasempa Mushitola Benson
SENIOR CHIEF KASEMPA

Cc: The District Agricultural Coordinator – Kasempa District
Cc: The District Commissioner – Kasempa District
Cc: The Council Secretary – Kasempa District
Cc: The Honourable Kabinga Mpande (MP) – Kasempa Constituency
Cc: The Permanent Secretary – North Western Province
Cc: The Provincial Agriculture Coordinator – North Western Province
Cc: The Provincial Fisheries Officer – North Western Province

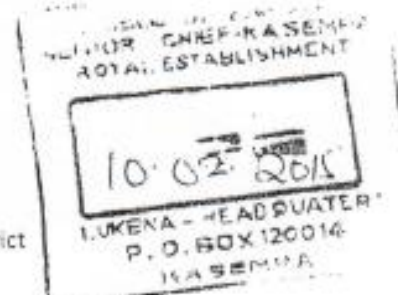




Figure 25: Site Location

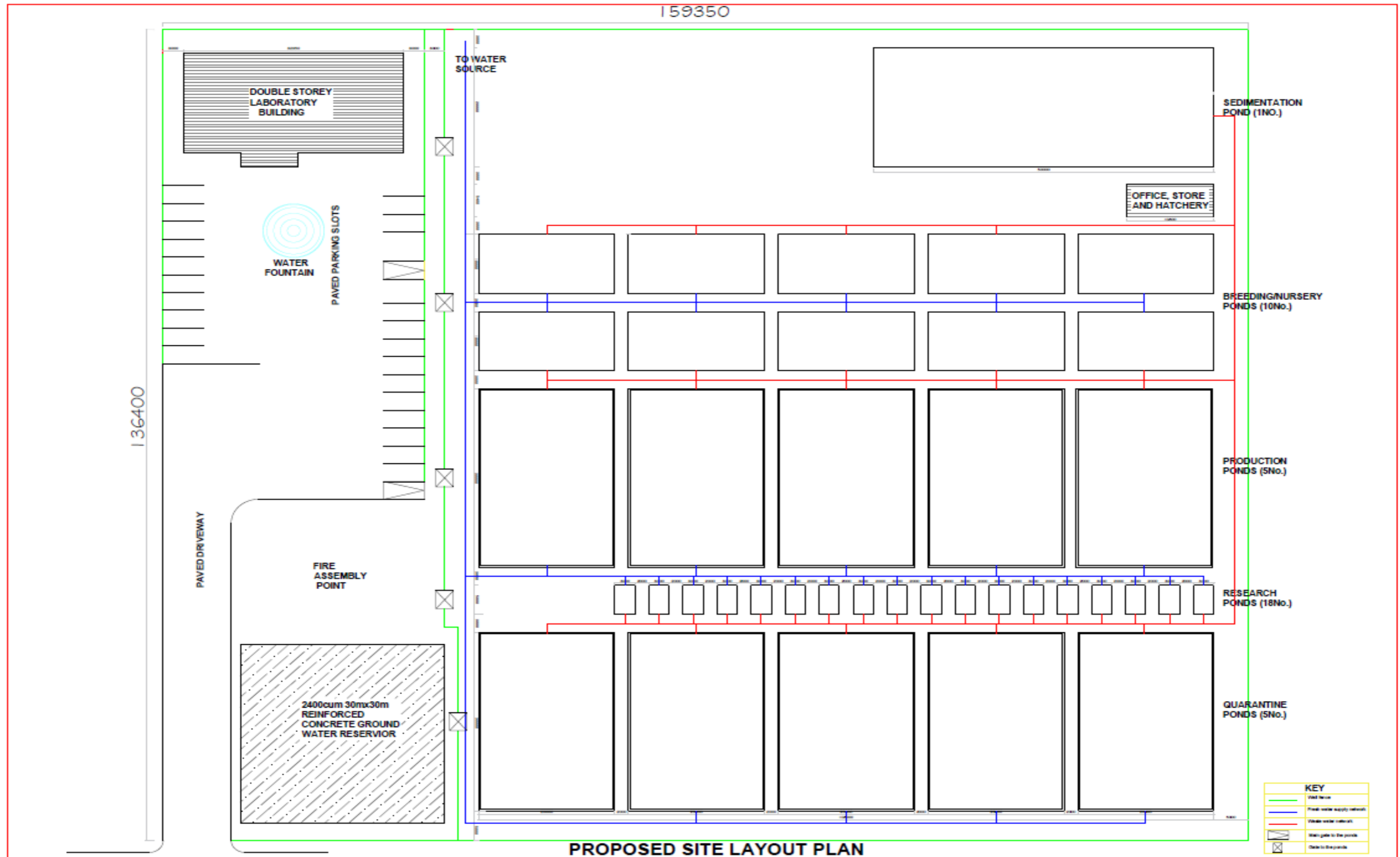


Figure 26: Site Layout