UNITED REPUBLIC OF TANZANIA

MINISTRY OF AGRICULTURE

NATIONAL IRRIGATION COMMISSION

TERMS OF REFERENCE

for Provision of Consultancy Services For

Feasibility study, Detailed Engineering Design of dams, Flood modelling, Environmental and Social Impact Assessment for the flood management works in Kinyasungwe Sub Catchment Area.

February, 2024

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1.0 Background Introduction

1.1 Introduction

The Government of the United Republic of Tanzania (URT) through Tanzania Railways Corporation (TRC) has applied for a credit from the International Development Association (IDA) equivalent to US$ 150 million towards the cost of the Second Inter- Modal and Rail Development Project (TIRP) and intends to apply part of the proceeds of this credit to eligible payments under the Contract for undertaking Feasibility study, Preliminary (conceptual) dams design, Flood modelling, Hydrology study, Topographical Survey, Geotechnical Survey, Environmental and Social Impact Assessment for flood management strategies at Kinyasungwe Sub Catchment Area.

This assignment is implemented in line with the Tanzania Development Vision 2025 which aims to ensure realization of food self-sufficiency and food security, and adequate level of physical infrastructure needed to cope with the requirements of the Vision in all sectors. In realizing the 2025 vision, several transport and other socio- economical infrastructures such as central railway line, irrigation schemes, Domestic water supply, livestock to mention a few, has been built/established between Dar es Salaam to Dodoma. However, some of these infrastructures have been frequently destroyed by floods. Irrigation schemes and other socio-economical infrastructures also face the same challenge including deficit of water during dry seasons.

The project is being implemented by National Irrigation Commission Component 2 and Tanzania Railways Corporation (TRC) Component 1,3 & 4 on behalf of the Government of Tanzania and will finance the following four components:

- Component 1: Strengthening of Railway Infrastructure and support of design studies
- Component 2: Strengthening climate resilience of Kilosa-Gulwe-Igandu section
- Component 3: Institutional Safety and Operational Support.
- Component 4: Contingent Emergency Rapid Response Component (CERC).

Beneficiaries of the Project are NIRC, TRC, LATRA, Agriculture, Fisheries, Livestock, and Water and Sanitation. The project is aiming to strengthen logistic capacity and develop the inter-modal and rail containers operations in TRC central railway corridor on Dar es Salaam – Tabora – Isaka. The main elements that have been identified as being critical to improve trains operations are;

(a) Capacity and reliability of railway infrastructure,

(b) Availability and reliability of rolling stock,

(c) Strengthening of logistic chains at rail-port interface and terminals of the project line section

(d) Well defined organizational structure and institutional responsibilities

(e) Improve water availability to irrigation activities, livestock and domestic use.

NIRC is an Independent Department of the Government under the Ministry of Agriculture intends to construct dams for irrigation schemes as a flood control measures in collaboration with TRC, the construction of dam for irrigation scheme also will help to overcome challenges regarding water scarcity for social economic activities such as livestock, domestic use with the goal of creating competitive and reliable transport system and sustainable agriculture fisheries livestock practice and natural resources management.

In that regard, the URT through the Ministry of Works and Transport and a motivation brought forward by Tanzania Railways Corporation (TRC) formulated a Team of Experts from different ministries, institutions and agencies for assessing Kinyasungwe catchment area and come up with the recommendations for a permanent solution for flood control between Kilosa – Igandu railway section.

In the course of executing their assignment, the Team observed that some of existing dams are in operational. Apart from the flood control initiative, the existing dams namely, Dabalo and Hombolo, which are located in the midstream of Kinyasungwe River are used for irrigation, livestock and fishery. The rest of the dams namely, Ikowa, Buigiri, Kimagai and Kidete are not functional due to excessive siltation and completely dry as of September 2022. Likewise, through National Irrigation Commission, the URT has facilitated construction of the new dams at Msagali (impounding capacity of 92,253,334 Cubic meter) aiming to irrigate more than 8750 acres and Membe (impounding Capacity of 12,000,000 Cubic meter) aiming to irrigate more than 8,000 acres within Mpwapwa and Chamwino District Councils, respectively. Construction of these dams will reserve a total of 104,253,334 cubic meters of the run-offs and consequently reduce the impact of floods on railway infrastructures located downstream of these dams. In spite of that outstanding initiative, further action needs to be imparted specifically on construction of strategic infrastructure for flood control.

The purpose of the existing and proposed dams is to serve as infrastructures with the primary aim of controlling flood downstream Kinyasungwe Catchment area and hence protecting the infrastructure (railway, road, and community services), private properties (farms, houses, and livestock) and utilities around the catchment. Such dams will also serve a purpose of supporting socio-economical activities such as agriculture, irrigation, fisheries, livestock, forest, beekeeping and if possible, hydropower generation. In terms of its design, it is provisionally proposed that the dams should have infrastructures to control sediment, silt and other debris, and store water permanently (wet dams) without affecting downstream users, including aquatic and terrestrial ecology that depends on discharged waters. The dams should also have facilities and capacity to provide services to support socio-economic activities.

Thus, the cascade of dams should have the capacity to withstand with a projected increase in run-off water which can cause flooding, sediment deposition as well as increase in water demand for other stakeholders in the next century. Due to importance of these infrastructures proper management systems should be instituted.

With purposes described above, revamping of those infrastructures at their proposed capacity would improve transport and other business environment, improve community services, livelihood and attract private sector investment in socio-economic activities in Kinyasungwe Catchment.

1.2 Kinyasungwe Catchment

Kinyasungwe/Mkondoa Catchment with the population of 1,303,829 (in 2016) and between 1.648 million (by 2025), and 2.116 million (by 2035), is the second most populated catchment of Wami/Ruvu Basin (WRB) (14% of WRB Population). It is located between latitude 50 4' 16''to 70 5' 34'' South and longitude 350 36' 55'' to 360 54' 22'' East (see sites maps in Annex 1). It has an approximate catchment area of 16,538 Square Kilometers (Sq.km) partly covering Bahi, Chamwino, Chemba, Dodoma Urban, Kongwa, Mpwapwa, Kiteto, Gairo, Kilosa Districts. The Catchment includes three major rivers of Great Kinyasungwe, Little Kinyasungwe, and Lumuma originated from Chandama highland located in Northwest of the catchment, which all end to Mkondoa River. Kinyasungwe catchment is rich with tributary Rivers such as Mzase, Sikoko, Kidibo (Mafugusa), Maswala and Mangweta which have water in the rainy season. Kinyasungwe has many other streams originating from Manyara and Dodoma regions and it discharges its water into Mkondoa River which flows throughout the year. The Lumuma, Nyakatwanga, Muvuma and Mdukwi rivers drain into the Mkondoa River which flows through the lowlands of Kilosa.

The catchment is of economic importance to the nation and community living around the vicinity as there is a central railway transport system stretching from Dar es Salaam to Kigoma through Kilosa and Dodoma constructed from 1905 to 1914. Also, there are other economic activities such as agriculture with several irrigation schemes, fisheries, livestock keeping, domestic water supply, forest etc. Historically, the surrounding areas of Kilosa town and infrastructures (railway, road, and community services), private properties (farms, houses, and livestock) and utilities around the catchment, faces the challenge of flooding since 1940's and the catastrophe continued even during 1997/1998-2019/2020 heavy rains. For instance, the Central Railway Line has been repeatedly damaged by floods (among a total of 40 floods in Kilosa–Dodoma during 2011–2014, 22 occurred in two specific locations: at Km 349 and at Km 365.6).

1.3 Description of the existing Dams

Six dams (Kidete, Kimagai, Ikowa, Buigiri, Hombolo, and Dabalo) and eight- kilometre- long embankment along Mkondoa River were constructed by the Colonial Government as the preventive measures to control flood. However, due to climate change and environmental degradation the dams have failed and some silted up due to heavy floods, sediment transport and tree debris. Mzase, Mafugusa and Maswala rivers all from Kibakwe slopes, are the main and active sediment discharge which affects railway operations and cause heavy siltation to Kinyasungwe catchment and contribute in decrease in dams' depth that affect other socio- economic activities along the catchment.

1.3.1 Kidete Dam

The Kidete Dam is situated along the Kinyasinguwe River at coordinates S 63° 8' 16" and E 36° 42' 12", some 500 meters upstream of the Kidete (village). Kidete is a homogeneous earth fill type dam (without a core) designed for flood control, water supply, and irrigation. The dam is around 25 meters in height, 200 meters along its crest, and 150 meters along its base. Dam surface area is 0.52 Sq.km and the catchment area is estimated to be 15,000 Sq.km. Currently there is no water stored in the dam because the flood flushed the dam embankment completely. The stream flow in the catchment area is about 1750 m^3/s.

The Kidete Dam, constructed in 1997, was positioned just upstream the Gombo Dam, built in 1940**.** However, a flood in November 1997 caused the Kidete dam's crest to be overtopped and downstream embankment material to be washed away. The river lengths between Kidete and Kilosa have suffered significant damage as a result of this dam failure. Due to financial restrictions, plans to repair the dam in 2010 were put on hold.

1.3.2 The Kimagai Dam

The Kimagai Dam is situated alongside the Kidibo River at Latitude 60 50' Longitude 360 52' Elevation 751 m. Kimagai is believed to be a homogenous fill type dam (without a core) designed for flood control, water supply, and irrigation. The dam's surface area was estimated to be 2.25 Sq.km. Currently there is no water stored in the dam because the flood flushed the dam embankments completely. The stream flow in the catchment area is about 1600 m^3/s.

The Kimagai Dam was built lately, in the 1950s, and is thought to have collapsed in 1955 or 1956. Since its collapse, no restoration measures have been implemented. According to site observations, the dam's siltation, spillway failure, and embankment erosion were the key contributors to the dam's collapse.

1.3.3 Ikowa Dam

Ikowa Dam, located at Chamwino District, Latitude 60 19' Longitude 360 22' Elevation 916 amsl, is

thought to have been constructed in 1957. No additional information is currently available for the dam; however, its catchment area is estimated to be 466 Sq.km with an annual flow of approximately 300m^3/s and currently storage capacity of the dam is estimated to be 200,000 m^3. Despite its current lower capacity, the dam is still in operation.

1.3.4 Buigiri Dam

Buigiri Dam is located at Chamwino District Council, Latitude 60 15', Longitude 360 03', Elevation 1,005 amsl, and is believed to have been constructed in 1960. There is currently no additional information available for the dam, however estimations place its catchment area at 10.36 Sq.km with an annual flow of approximately 300m^3/s and storage capacity of the dam is estimated to be 150,000 m^3. Despite its current lower capacity, the dam is still in operation.

1.3.5 Hombolo Dam

The Hombolo Dam is located at Dodoma City in the Hombolo-Bwawani village 63.6 kilometers from the City Center, at Latitude 50 95' Longitude 350 96' Elevation 1,053 amsl. The Little Kinyasungwe River feeds the dam. Hombolo Dam has a history of supporting local livelihoods, such as fishing and irrigation farming, minimizing the consequences of flooding, and reducing water usage for human and animal consumption. 1,684 Sq.km is estimated to be the catchment area with an annual flow of approximately 1000m^3/s and storage capacity of the dam is approximately to be 30,000,000 m^3. Since 2005 the dam's capacity has been declining due to lack of maintenance, Environmental degradation this leading to failure to achieve the intended desired goals.

1.3.6 Dabalo Dam.

The Dabalo Dam is situated in Chamwino District, Dodoma, upstream of the Great Kinyasungwe River. Latitude: 50 80', Longitude: 360 11', approximate terrain elevation above sea level: 1032 amsl. The dam was built in 1961 as a stream impoundment barrier over a stream with approximately 400,000m^3 and River annual flow is estimated to be 300m^3/s. The reservoir is susceptible to siltation since the Upper Great Kinyasungwe's landform is flat and there is likely to be sediment flow in the dam.

The government through its different institutions continued to mitigate the flooding effects from the Kinyasungwe/Mkondoa catchments independently including restoration of infrastructures, services and conduction of various studies. Despite of these efforts there is frequent occurrence of floods cause disasters which cost Tanzania Railways Corporation (TRC) about TZS 3 to 6 billion annually for the restoration of affected railways infrastructures and loss of business worth approximately 2 billion per year while other socio- economic activities are affected.

Several studies and initiatives recommended reconstruction of the Kidete, Kimagai, and Msagali dams,

along with other sediment control measures as the flood preventive measures. Other studies highlighted and projected the water run-off and water demand for different stakeholders along the catchment and recommended construction of new flood control infrastructures. In some studies, they also documented engineering drawings and estimated budget for the rehabilitation or construction of infrastructures. Other initiatives showed how dams and water resources are managed and demonstrated the impact of dams on economy.

Nevertheless, the impact of human activities on the life span of the dams were also recorded and recommendation on control measures were provided. Sedimentation and siltation were also reported, and it was documented as the cause of decrease water depth in most of the dams. Such initiatives and studies might have gaps such as lack of hydrological information for the specific/targeted catchment area, proposed upstream interventions and limited stakeholders' involvement.

The consultant is expected to review all initiatives and recommend existing situation and provide expert advice on a proper sustainable intervention and its estimated cost. In the context of the above, the URT is seeking to contract a qualified and an experienced firm (Consultant) to undertake the Detailed Engineering Design, Preparation of Procurement Document, Environmental and Social Impact Assessment for the flood management strategies at Kinyasungwe Sub Catchment Area. The Consultant is also expected to define and discuss a "modular" approach, defining interventions according to priority.

2.0 Scope of Work

2.1 Overall objectives of the Services

The following are Detailed Scope of Services and TORs but not limited to;

i). Carryout condition surveys of the flood management infrastructure in the Kinyasungwe river catchment such as Kidete, Kimagai, Ikowa, Buigiri, Hombolo, and Dabalo dam embankments along Mkondoa River and other flood management embankments. Carry out required hydrological study, Geotechnical studies, flood analysis, surveys and investigations and identify mitigation measures, reconstruction and rehabilitation measures and works that are required to bring all these facilities to an acceptable level of operation for optimal water/flood management in the basin;

ii). Prepare detailed design studies for these mitigation measures, rehabilitation, reconstruction or new construction works, carry out technical, economic, environmental and social impact assessments and prepare an optimal implementation and procurement plan for implementation of all these works priorities and through appropriate procurement contract packages.

iii). Prepare flood modeling for Kinyasungwe Sub- Catchment area.

iv). Prepare detailed designs and bidding documents of all works and contract packages, including bill of quantities (BOQs) technical specification, tender documents, drawings; and

v). Provide technical assistance and training to project implementation team.

The detailed scope of services is described below:

2.2 Task A: Review of existing information, data collection, condition surveys, analysis and preparatory studies.

This would include, but not limited to the following:

i). Collect and review all the information Wami/Ruvu and, in particular Kinyasungwe river catchment and water/flood management infrastructure in these areas. In particular, review the six dams listed above in the Kinyasungwe river catchment and flood embankments;

ii). Review available detailed design reports, technical specifications, and as-built or design drawings, design and construction records including geological reports, foundation investigations, materials testing, materials strength parameters and stability analysis.

iii). Review the criteria, methodology and determination of the design flood, flood routing studies and the spillway sizing. Examine spillway operation records and evaluate the adequacy of the spillway capacity.

iv). Review any previous dam safety inspection reports as well as recent operation & maintenance (O&M) records and any instrumentation data, such as reservoir level, inflow & outflow volume, spillway discharge volume, seepage volume, settlement, working or electro-mechanical equipment, spillway gates etc.

v). Review the safety inspection and periodic safety review reports performed by dam owners and check the quality of such reports based on the expert's own site visits/field inspections.

vi). Carry out site visits and detailed conditions surveys of all existing facilities for water/flood management in the basin;

vii). Carry out Geomorphological study, sediment transport studies of the river and impacts on the floods;

viii). Undertake climatological and hydrological analysis, update the design flood, check flood and Probable Maximum Flood and dam break analysis for various water/flood management infrastructure;

ix). Review the existing flood management facilities in the dams and determine the design, flood routing studies, and spillway sizing; check the spillway operation records; and evaluate the adequacy of the spillway capacity considering current and future conditions;

x). Assess conditions of the catchment area, reservoir rim slope, and downstream areas, and provide an expert opinion on potential effects on safety of dams and downstream communities;

xi). Conduct field and site investigations as required inspection of the dams and associated structures, such as spillway, outlet structures, and gates or valves; water intake; saddle dam; control and monitoring instruments and so on;

xii). Assess the capacity of the organizational structure, staffing, skills, budget, equipment, and facilities needed to operate and maintain the dams in a safe and sustainable manner and advice proper management of the dams;

xiii). Provide key findings of the overall safety condition of the dams and other flood management infrastructure and recommendations of required structural and non-structural remedial measures based on the potential risk of the dams and other flood management infrastructure;

xiv). Undertake structural integrity tests of existing embankment, fill materials, capacity of existing embankment when loaded, capacity of existing embankment when loaded with new raised embankment;

xv). Undertake structural integrity and corrosion check of existing concrete-based dam components, i.e., sluice gates, spillway, intake chamber, outlet systems, irrigation systems at outlet;

xvi). Determine the seepage pathways, leakage locations, and stability of core structure after dam become operational to the full water supply level

xvii). Determine Cracks on dam embankment, sizes of crack, extent of cracks,

xviii). Determine slope stability of embankment, potential erosion, vegetation cover, impact of vegetation, extent of roots

xix). Determination Sedimentation depth, sedimentation load, and potential dredging techniques e.t.c,

xx). Determine hazard assessment of existing sites, determine existing condition of the river and potential new sites for Kidete and Kimagae site, (or justification to remain at the site location)

xxi). Determine initial assessment of sedimentation control facilities in each dam, types, locations, efficiency;

xxii). Prepare a comprehensive picture of flood risk and to evaluate the effectiveness of different flood management strategies through the Integrated Flood Management (IFM). Design and Engineering Study;

xxiii). The consultant shall review the previous studies and with topographical, hydrological and climatological survey reports and liaise with relevant authorities to locate reliable flood control points both downstream and upstream of vulnerable flood areas. Regarding the control points, the consultant should predict change of flood areas and, based on the new and existing flood areas recommend the size, number and locations of the proposed control points/dams;

xxiv). Carryout the seismology and earthquake studies for area and various structures;

xxv). Based on condition surveys and associated studies, identify the rehabilitation, reconstruction and mitigation works required to bring these water/flood management dams and facilities back to operation according to the acceptable standards;

xxvi). Carry out required topographical surveys and geological studies to design the mitigation and reconstruction/mitigation works;

xxvii). Carry out options analysis and propose best and least cost for carrying out these works; and

xxviii). Prioritize the works for implementation and package them into packages for designs, procurement and implementation.

2.3 Task B: Prepare Detailed Design of the selected works for implementation.

For all works selected under the Task A, the consultant would prepare detailed designs covering technical, engineering, environment and social aspects. This would include, but not limited to the following activities.

2.3.1 Task B1: Technical and engineering aspects of the works.

a) For the works identified under Task A prepare optimal contract packing for procurement and construction. The works would be procured and constructed using World Bank Standard Bidding documents for large Works;

b) Prepare detailed designs with suitable details required for bidding, Bill of Quantities (BoQs), engineering drawings, etc. technical specifications of all materials and equipment, and prepare the bidding documents for components of the works;

c) Locate and identify borrow areas for material to be used for construction, rehabilitation and mitigation and carryout out proper assessment and associated technical studies;

d) Prepare detailed design for the structures, gates, embankments, dykes, gates and associated and ancillary facilities and other works to be carried out under the project for various facilities to implement an over flood management plan;

e) Prepare detailed structural and hydraulic design and specifications for the dams, spillway, intake, waterway and other appurtenant structures;

f) Prepare detailed drawings necessary for tendering, construction including plans, profiles, cross-sections and detail of the dams, spillway, intake, waterway and other appurtenant structures;

g) Prepare and include in the bidding documents employer's requirement and requirements of the engineer for construction supervision;

h) Prepare bidding (and other procurement) documents, based on current World Bank Standard Bidding Documents and forms of contracts;

i) Prepare detailed engineer's cost estimates for each contract package, construction period, warranty period etc;

j) Prepare pre-qualifications documents for large contracts as agreed with the Government and the World Bank.

2.3.2 Task B2: Environmental Assessment and Environmental Management Plan.

Consultants would undertake Environmental Assessment (EA) and prepare and Environment Management Plan (EMP) for each sub-project, in this case each contract. EA/EMP would make part of the design reports and summary reports would be included in the main design report. The EA/EMP should be consistent with the procedures for conducting the Environmental Assessment and in conformity with the clearance requirements of the Government of Tanzanian, and the World Bank Operational Policies on Environmental Assessment. The sub-project/contract EA/EMP would be prepared in line with overall Environment Management Framework (EMF) prepared for the Project. The EA/EMP should cover potential environmental adverse impacts of the construction activities as well as of the operation of the Project. EMP would consist of mitigation measures, a monitoring program, an institutional development/strengthening program for the implementation of the EMP and cost estimate for its implementation. Prepare scope of work, terms of reference and a plan of how various mitigating measures would be implemented either through making them part of the of construction contracts for project facilities or through additional works or consultancy contracts. The EMP would be incorporated to the extent possible in the construction contract where it is not possible additional works would be deigned. As part of the EA process, carry out, but not limited to the, following activities:

a) Collect and update information on Physical Environment. Physiography, climate, geology and seismology, soils, hydrology, groundwater, flooding, water quality, air quality, noise, and others.
b) Collect and update information on Biological Environment. Forests; natural vegetation i.e., trees, shrubs, herbs, scrub, grasses, medicinal plants, and others; fauna i.e., mammals, birds including migratory birds, reptiles, amphibians, insects, red listed species, fish species; biodiversity including carrying capacity; protected and non-protected areas including hunting, poaching, illegal fishing, benthic flora and fauna;
c) prepare the inventory of the trees to be cut for construction and a plan for tree plantation plan;
d) prepare inventory and maps of the protected areas including games reserves, wildlife sanctuaries, wetlands and other natural habitats within the irrigated areas, and particularly in the sub-Project areas;
e) Assess possible impact of project works on adjacent protected areas or areas of ecological significance and include these in the design report. If necessary, propose and design alternatives and/or remedial works in such circumstances through detailed protected area management plan;

f) Assess the effectiveness of on-going pest management plan and recommend measures to bridge the gaps in its implementation and enhancing benefits for the betterment of environmental conditions associated with improved irrigation.

g) Prepare cumulative environment assessment considering all ongoing, in planned and future schemes and their possible impacts.

h) Assist in review and clearance of EA/EMP from the monitoring and evaluation consultants, Tanzania NEMC (Tanzania EPA) and other relevant authorities and the World Bank,

i) Propose Institutional Arrangements: provide assessment of the institutional arrangements with clear role and responsibilities of implementation agencies including, Supervision Consultant and contractors. Identify capacity building needs related to environment, health, safety and social aspects within the implementing entity and project staff. In particular, the occupational health and safety (OHS) practices during construction as well as O&M phases will be studied. Formulate recommendations for capacity enhancement based upon above assessment.

j) The Legislative and Regulatory Framework: The report on the Legislative and Regulatory Framework should include review of the national and provincial environmental requirements. Indicate relevant international environmental agreements to which the country is a party. Review WB Environmental and Social Framework (ESF) as well as Environmental and Social Standards (ESS) relevant to the Project and state the actions taken/planned in response to each ESS and review of World Bank Group Environmental, Health and Safety (EHS) Guidelines. As per initial assessment, ESS1, ESS2, ESS3 and ESS10 of WB ESF is relevant to the project and consultant is expected to review the requirements under these ESSs. This section should also include analysis of legislation on labor and working conditions, as well as any regulations on public consultation and dissemination of information.

k) Analysis of Alternatives: Analysis of Alternatives should systematically compare feasible alternatives to the proposed project site, technology, design, and operation--including the "without project" situation--in terms of their potential environmental and social impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training, and monitoring requirements. For each of the alternatives, quantify the environmental and social impacts to the extent possible, and attach economic values where feasible. State the basis for selecting the particular project design proposed and justify recommended emission levels and approaches to pollution prevention and abatement

l) Findings of Detailed Baseline Studies and Analysis: Detailed baseline studies and analysis should assess the dimensions of the study area and review relevant physical, biological, and socioeconomic conditions, including any changes anticipated before the project

commencement. Study current and proposed development activities within the project area but not directly connected to the project. Also analyze the trends in the key environmental and social parameters of the area. Data should be relevant to decisions about project location, design, and operation.

2.3.3 Task B3: Social Impact Assessment and Resettlement Action Plan.

Consultants would prepare sub-project specific social assessment in accordance with the overall Social Impact Management Framework (SIMF) of the project and Bank Guidelines and include in the design report. In this regard, Consultants would undertake, but not limited to the, following activities:

i). Collect information about the social environment. Population and demography; socioeconomic characterization of the population household size, age, gender (existing country gender diagnostics; country-wide and region-specific data violence against women; data and/or information on cultural practices vis-à-vis women (early marriage, physical practices); existing services available from gender-based violence (GBV) services providers, quality, accessibility and gaps), ethnicity, language, literacy/education; social organizations and dynamics and types of vulnerability; health and education levels; access to basic services and facilities such as healthcare, education, drinking water and sanitation etc.; income and occupation; assets; sources of livelihood (particularly for women); land use and natural resources including agriculture, livestock, grazing, forestry; land tenure system; occupations structure; household income and expenditure; economic activities e.g. quarrying of minerals, tourism, fisheries, trade, services; social infrastructure and services including education, health, communications, others; vehicular traffic particularly used for commercial activities; access, law and order and security situation; community organizations; vulnerable groups and poverty situation; gender aspects; recreation areas/potential; cultural heritage; archaeology; objects of special interest, e.g. graveyards and monuments; and others

ii). Undertake social assessment of the Project and its sub-projects; carry out social impact assessment due to possible changes in canal operation and/or closure during construction. Prepare construction methods and propose measures to minimize the disruption to canal supplies/operation during construction and propose mitigation measures to address any negative impacts;

iii). Undertake surveys to determine any “cultural property” (according to definition of United Nations) including sites having archaeological, paleontological, historic, religious, and unique natural values in the project area and prepare proper documentation for such a cultural property. Determine the effect, if any, the Project may have on the cultural property and develop a plan for its preservation; also develop procedure for handling any “chance find” during construction;

iv). Quantify the social impact of the project works on the project affected persons (PAPs) and prepare appropriate mitigation plans and Resettlement Action Plan (RAP) according to the Government policies and the World Bank Guidelines on involuntary resettlement and provisions of the Project social framework;

v). Consultants would prepare **full Resettlement Action Plan (RAP)** when applicable and in this context major activities to be carried out would include, but not limited to the following:

a) Collect basic data needed for preparation of RAP; this would include (i) full census of affected persons—landowners (resident and non-resident), family members; (ii) full inventory of assets affected—land, structures, crops, productive trees; (iii) estimate of impact of loss on income of each household; (iv) compilation and analysis of laws pertaining to land valuation, acquisition and expropriation; (v) analysis of standard practices for land valuation, acquisition and expropriation; (vi) documentation of efforts made to minimize land acquisition/resettlement; and (vii) fully articulated options available to affected persons.

b) Establish a bench mark situation, sketch out property, houses, and other structures, trees vegetation, geo-profile in a map covered by the project works. Video-tapping may be used to support the bench mark situation;

c) Prepare alternatives to minimize land acquisition, the resettlement and displacement, prior to project start as well as during project implementation;

d) Design and implement a program to involve beneficiaries in project conceptualization, planning and implementation and to facilitate public awareness of the project and enhance its ownership;

e) Identify sites for relocation, involve PAPs in preparing alternatives for relocation sites, and preparing strategy for site and housing replacement;

f) Describe entitlements for each category of impact and specify that resettlement implementation will be based on specific provisions of agreed framework and the RAP; describe method of valuation used for affected structures, land, trees, and other assets; and prepare entitlement matrix; describe grievance redress procedures, for registering complaints, mechanisms for appeal, and process for approaching the civil courts;

g) Prepare a resettlement plan entitlement and policy matrix;

h) Propose institutional and organizational arrangement for the implementation of RAP including linkages with the Project implementing, local administration, NGOs and other related entities;

i) Prepare cost estimates of RAP implementation separately identifying the administrative costs, consulting services, equipment, and compensation under major categories, such as land, houses, trees, other property, cost of preparation of alternative sites, etc; and

j) Prepare RAP implementation arrangements and identify critical path actions for timely implementation of the project.

2.3.4 Task B4: Preparation of Environmental and Social Management Plan (ESMP).

The Consultant is required to:

a.) Combining the EMP and SMP (including RAP if required) Consultants would prepare combined ESMP that should include mitigation plan, compliance monitoring plan, effects monitoring plan including pollution prevention plan, construction camp management plan, occupational health and safety management plan, community health and safety management plan, traffic management plan, emergency response and preparedness plan, labor influx management plan, SEA/SH action plan (prevention and mitigation actions, awareness raising strategy targeting workers and communities, SOPs in the light of government instructions, World Health Organization (WHO), and World Bank for management of risks related to COVID-19, institutional arrangements for implementation and monitoring, training needs, documentation and communication protocol, grievance redress mechanism, cost of implementing ESMP, and mechanism to integrate ESMP with the project (e.g., through contractual clauses).

b.) Environmental and social management plan should be prepared in such a way that the maximum items in mitigation and monitoring plan can be later incorporated in the bidding document as part of the Bill of Quantities (BoQ). The ESMP should follow the World Bank (WB) ESF, WBG EHS, Labor Influx, and SEA/SH Guidelines.

c.) Institutional Arrangement and Budgetary Estimates should identify the institutional mechanisms, responsibilities, and budget, including monitoring and inter-agency coordination needed to implement the ESMP and ensure all environmental and social considerations, as well as prevention, mitigation and management aspects are properly operationalized.

d.) Capacity Building discussion should include an assessment of institutional capacity to ensure proper environmental, social, health and safety management of the project, including implementation of sub-project environmental and social management and monitoring plans, and propose capacity.

2.3.5 Task B5: Conduct Topographical Survey

The following describes in detail the minimum activities to be executed by the consultant in order to achieve the set of objectives summarized above. However, the consultant alone is responsible for the sufficiency of his work and these Terms of Reference (ToR) are not intended to be exhaustive but to serve as a guide in showing the minimum of work required to achieve the desired output.

2.3.5.1 Topographic Survey

Consultant will be required to:

i). Carry out topographical surveys to facilitate the location of permanent control points, structures, and computation of quantities of earthworks.

ii). All topographical detail surveys undertaken by the Consultant shall be according to the Land Surveying and Mapping Standards of Tanzania, and shall be recorded in standard survey field books/electronic data book, which shall be submitted and become the property of the Client at completion of the assignment.

iii). Permanent control points shall be established at a maximum interval of 250m along the dam site, thereafter to be distributed to a maximum of 500m as secondary points, which should be inter-visible along the irrigated area.

iv). Monumentation of all primary control points shall be made using 16mm steel pins embedded in 1.0m deep cast in-situ concrete. The description cards for the control points shall be prepared and submitted to the Client and detailed in the report to be submitted to the Client for future reference

v). The Consultant shall liaise with the Ministry responsible for Lands for the existing National Grid/Datum reference beacons and benchmarks in order to establish the permanent control points. The co-ordinates of all intersection points shall be in the Universal Transverse Mercator (UTM) system and shall be tied to the National Survey Grid, and levels related to the National Benchmarks.vi. The topographic data shall be available and presented on maps with a scale of 1:4000. In addition, electronic copies of the topographic data saved in MS Excel and topographic drawings in DXF or DWG format shall be submitted in CD ROMs to the Client and become his property.

vi). The Consultant shall carry out topographic mapping of upstream and downstream area (Reservoir Area).

vii). The Consultant shall survey and prepare a Dam site map with a grid system of 25m x 25m interval at scale of 1:1000 and contour interval of 0.5m intermediate contour, and 1.0m index contour.

viii). Topographical Maps of potential access roads, site camp, and permanent housing area and construction facilities shall be prepared with a scale of 1:2000 and contour interval of 1.0 meter.

ix). The Consultant shall survey and prepare downstream map with a grid of 25m x 25m intervals at 1:5000 scale and contour intervals of 0.5m intermediate contour and 1.0m index contour plus river cross-section covering at least 5km: at every 25m interval.

x). The Consultant shall prepare aerial digital photography in full colour of the project area that will be used to produce geo referenced ortho photo mosaics maps of 1:5000 scales. The following specifications are expected in this kind of activity:

- Ground resolution: Pixel size (0.15-2m)
- Digital terrain model with a 15 cm pixel with 15 cm spot height. Spectral resolution: Visible channels red, green, or blue
- For accurate determination of dwellings, affected properties/infrastructure, a resolution of 2 meters is preferred. Geometrical accuracy: 2-5 m with control points.
- Coordinate system: UTM (WGS 84)
- Format: Geo coded TIFF

xi). Using the mapping results, the Consultant shall determine suitable dam site at a suitable scale to determine dam body volume, H-V-A curve, define relationship between reservoir volume and inundation area along with reservoir depth (water elevation).

xii). Determine location of associated infrastructures including spillway and communities' settlement areas

2.3.5.2 Detailed Field Topographical Survey

Detailed Topographical survey will be undertaken as follows;

a.) Establishment of Survey Benchmarks

For dam, a network coordinated of benchmarks should be established in the project, at safe places alongside all major points and drains, at the dam embankment site and places of major structures together with the catchments area before any survey work starts.

Benchmarks should be located on permanent features, which are unlikely to be altered or destroyed during the construction stage.

Drawing(s) showing the locations of these benchmarks together with list showing their identification prefix, levels and coordinates should be prepared and presented in hard and soft copies,

b.) Catchments and Reservoir Area Survey

A complete topographic survey of the catchments and reservoir area should be done in order to identify the project's general land topography and to obtain all the necessary existing physical features in the area. In detail the following activities should be undertaken:

Carry out spot levels on a 50x50m grid interval covering area of about 3km d/s and 1km u/s from the center of proposed dam embankment. Additional levels should be taken when necessary wherever there are remarkable changes in slopes or in case of getting necessary features such as road, dwellers area etc.

Pick up and map details (location) of all important existing features whether natural or man-made,

such as farm channels, drains, roads, structures, valleys, gullies, hills, spillway position, the boundaries of the embankment and catchments areas.

Contour mapping should be carried out at a scale of 1:2500 with contour interval of 0.5m.

c.) Dam embankment site survey.

Site survey for dam embankment site is required with following details:

Topographical maps of the proposed Dams embankment site which covers proposed dam level on each side of the river/gully, upstream and downstream of the embankment location should be prepared at a scale of 1:1000 or 1:500.

Contour interval should be 0.5m or more depending to the topography of the site.

River cross sections are required at an interval of 50m to cover 200m upstream and 100m downstream at 25m long across the river.

Dimensions and elevations of the existing dam embankment should be clearly presented.

d.) River Survey

River surrounding the project areas should be surveyed and shown to facilitate the design of catchments and dam embankment.

e.) Road Survey

Roads and important foot path within the project area should be surveyed and shown clearly.

Location of structures e.g. culverts, Electric poles e.t.c should be indicated in the profile. In addition, all breached area should be indicated.

f.) Site Guidance

All benchmarks erected along each profile line will be shown and handed over to community for security and guidance.

2.3.6 Task B6: Hydrology and Water Resources

The Consultant will be required to perform the followings activities but not limited to:

i). Assess the data quality available water runoff and rainfall data;
ii). Carryout flow measurement in the river (if any) at the proposed Dam site;
iii). Quantify monthly runoff at different sites location;
iv). Adopt appropriate hydrological techniques to derive the required design flow including extreme river flow and hydrological statistic from the nearest available gauging station, where sufficient hydro- meteorological data are not available;

v). Assess the spatial and season fluctuations of climatic variables on the hydrological characteristics for the project;

vi). Undertake hydrological analysis to estimate reservoir yield, design floods to facilitate design and sizing of various hydraulic structures such as reservoir, spillway and outlet structures;

vii). Determine the current and potential future water uses at the project area;

viii). Assess and quantify current and planned upstream water uses and their impact to the proposed project;

ix). Determine sediments load including the projections of future changes in upstream sediments release based upstream development plan;

x). Forecasting of dead storage volume and the future rate of reduction of live storage and reservoir trap efficient;

xi). Assess and quantify current climate change impacts on river basins and associated economic activities and large-scale infrastructure, including dam/reservoirs.

2.3.7 Task B7: Geological and Geotechnical Investigation

Consultant will be required to determine to perform the following task but not limited:

i). The general geologic and tectonic setting of the site area by analysis of the lithology, stratigraphy and structural geology and tectonic history and through existing relevant documentation;

ii). The geologic conditions related to selection of Dam site;

iii). The characteristic of the foundation soils and rocks;

iv). Other geologic conditions (such as fault) that may influence design, construction and long-term operation;

v). Seismicity and earthquake intensity in the project area;

vi). Locate construction material in the vicinity of the project area and conduct material test;

vii). Geophysical properties through trial pits at appropriately selected locations for soil identification and assessing soil engineering properties relevant for the project;

viii). Uncertainties arising from interpretation of geophysical results and their possible impacts on cost and project viability;

ix). Geological profile for the irrigation weir (if any) and Dam foundations, reservoir rim area, spillway and potential project command area, showing all geological structures in place and inducing the potential permeability and stability;

x). Geological map of the reservoir and rim, drawn to sufficient detail commensurate to permit identification and assessment of potential leakage path;

xi). Geo reference with reporting on map possible sources of construction materials, and carry out basic tests to assess their engineering properties;

xii). Conduct a series of geophysical investigations/tests relevant to the dams and catchment area an such as but not limited to seismic refraction, bore holing/logging, trial pits, in-situ and laboratory tests (refer to 'f' above)

2.3.8 Task B8: Cost Estimates, Benefits and Economic and Financial Analysis.

The activities under this would include, but not limited to the following:

i). Based on the detailed analysis, studies and using appropriate methods to extrapolate various parameters prepare cost estimate of the Project (engineer's cost estimate for the contract) including all costs, engineering, social and environmental as well as construction management and supervision;

ii). Estimate total project costs, benefits and economic and financial returns for the total project. Identify project risks and carry out sensitivity analysis and impact on the economic rate of return; and

iii). Propose optimal design considering economic returns.

2.3.9 Task B 9: Operation and Maintenance (O&M), Cost Recovery.

i). Estimate O&M requirements of the Project and breakdown by its various facilities over its life;

ii). Propose effective institutional arrangements, cost recovery, water rates/tariff for ensuring the proper O&M of the Project;

iii). Identify equipment, office and other facilities required for O&M of the project facilities; and

iv). Suggest any system for cost recovery of these infrastructure from the beneficiaries and other stakeholders, capital and O&M costs along with the arrangements.

3.0 Implementation Arrangements

3.1 Assignment Period.

The total contract period of the assignment will be six months and phased in the following manner:

i). Topographical survey, social and environmental, economics, geotechnical, soil, hydrology and all other studies shall be conducted within three months from start of the consulting services;

ii). Preliminary Design, technical, with approximate costs would be issue by the 4th month of the consulting services; and

iii). Detailed designs and bidding documents and all completed reports would be issued by the 6th month of the assignment.

3.2 Access to Data.

The Government and its Ministries, Departments or Agencies will give the consultants access to all available data.

3.3 Staffing Requirements.

The consulting firms are free to propose staffing plans to meet the scope of services. However, following key staff would be required for the assignment:

3.3.1 Team Leader: Civil/ Irrigation/Water Resources Engineer Specialist

Qualifications: The Team Leader (TL) shall be a registered professional engineer with proven experience in Water Resources Management activities that include Dam/Reservoirs and be familiar with Dam/Reservoir design, development of irrigated schemes and planning and construction disciplines. Shall have a minimum MSc degree qualification and with a minimum of ten (10) years overall experience and Ten years (10) years relevant experience on similar dam/reservoir design projects and proven experience in leading multidisciplinary teams and/or team leader for externally financed projects preferably in developing countries. Fluent in written and spoken English and an ability to draft concise reports; good communication skills; excellent computer skills, working experience with project management systems are essential *in developing countries particularity in Africa*.

Responsibilities: The Team Leader will be responsible for the overall management and coordination of the overall studies and cooperate closely with the Executing Agency project team and counterpart decision makers. Responsibilities will include but not limited to:

i). Manage, coordinate, and ensure quality assurance, agreed implementation program and timely delivery of all deliverables of the assignment are adhered

ii). Focal point between the members of his team and the client.

iii). Capable of formulating an overall program to ackle the problems of developing irrigation schemes and land husbandry, etc.

iv). Take lead in preparation and submission of reports and deliverables of the assignment.

v). Prepare detailed, time-bound work plans and assigning various team members to each key task;

vi). Provide technical support and guidance in all aspects of the consultancy services;

vii). Organize and take the lead for carry out of diagnostic study step 1-4 in accordance with the Comprehensive Guideline (CGL) of irrigation Development.

viii). Organize and take the lead in the conduct of regular visits to the site and irrigation service areas for the technical supervision in undertaking the required survey and mapping, and carrying-out of confirmatory tests;

ix). Monitor the progress of all planning and design work ensuring that deadlines relating to delivery dates are met;

x). Take lead and assign/delegate other tasks/activities to the members of the Consultancy Team and support staff as may be required during the conduct of the Study, undertaking of the VE/VA Study and vulnerability assessment for the proposed project;

xi). Ensure the timely delivery and quality control of all required outputs; in particular, the Inception Report, VE/VA Report, Monthly Progress Reports, Interim Report, Draft F/S Report, and Final F/S Report; and

xii). Supervise and guide the individual experts and ensure that they are coherently engaged in studies activities to collectively deliver the required outputs;

xiii). Take lead in the preparation and submission of reports and deliverables of the assignment.

3.3.2 Deputy Team Leader: Civil/ Irrigation Engineer

Qualifications: Deputy Team Leader shall be a registered professional Engineer and must have a proven experience in design and assessment of various civil works and infrastructures including road-works, appurtenant structures of Dam/Reservoirs, underground works, hydraulic canals related to large Dam/ Reservoir and irrigation

projects. Shall have a Bachelor degree in Civil/ Agricultural/Irrigation Engineering or equivalent and a minimum of 15 years overall experience and 10 years relevant experience on similar Dam/Reservoir and irrigation projects design and implementation in developing countries particularity in Africa.

Responsibility: He/ She will work as deputy team leader in the following;

a) Assist the Team Leader in the overall supervision of the various assessment study activities;
b) In the absence of the Team Leader, assume full responsibility, including leadership of the Consulting team;
c) Undertake the review/updating of design and cost parameters considered in previous studies, in coordination with the other key experts;
d) In collaboration with other experts/specialists, select the most appropriate scheme for the objective of the project based on comparison of alternative schemes of development. Recommend the definitive viable, acceptable, and doable plan for implementation;
e) Conduct site inspection/field investigation to determine the extent of topographic and mapping necessary for design and design review. Classify the type of terrain, meandering of the river, and water ways;
f) Using data gathered from survey, perform hydraulic analysis for discharge (e.g., flood routing, afflux analysis) depending on the scheme to be implemented. This also involves sizing of diversion conduit, sluice gate/s, ogee weir, and other related structures;
g) Prepare cost comparison for the different schemes under consideration and use this as input in the determination of the appropriate project development;
h) Take the lead in preparing the drafts of the Inception Report, VE/VA Report, Monthly Progress Reports, Interim Report, Draft F/S Report, and Final F/S Report; and
i) Undertake other tasks/activities assigned/delegated by the Team Leader as may be required during the conduct of the Study.

3.3.3 Civil/ Irrigation/Structure Engineer

Qualifications: A minimum Master's Degree in Civil/ Irrigation/Structural Engineering with at least 10 years of relevant experience in Dam/ reservoir design, irrigation planning, design and implementation particularity in Africa. He/She shall be a registered professional Engineer.

Responsibility: He/ she shall be responsible in;

a) Undertake design of Dam and review the existing designs
b) Update of and Assess drainage system and improvement needs in the project area;
c) Adopt and recommend innovations/other available alternatives or technology into the design of canal and drainage systems improvement that will improve farming operation throughout the service area;
d) Provide a map showing the name, location and the general description of the project;
e) Provide a general layout of the project showing the service area, Dam Components structures and other Important structures;

f) Show the plan and profile of Dam axis, Canals and indicating its related structures;
g) Show the proposed implementation organization;
h) Undertake other tasks/activities assigned/delegated by the Team Leader as may be required during the conduct of the Study

3.3.4 Hydrologist

Qualifications: The hydrologist shall have University degree in Hydrology, Civil/ irrigation /Water resources Engineering. The Hydrologist shall be a professional with proven experience in hydrological data analysis and modelling in connection with river basin management and dam/reservoir designs in developing countries. They shall also have proven track record in

i) climate change modelling and scenario building, and

ii) climate change impacts on river basins and associated economic activities and large-scale infrastructure, including dam/reservoirs.

He/ she shall also have experience in hydrological and flood modelling related to the multipurpose benefit assessments in cooperation with the economist. He/ she shall have a minimum of fifteen (15) years overall experience and ten years (10) years relevant experience.

Responsibility: The Hydrologist will be responsible in collecting and review of all hydro-meteorological and river flow data and carryout all necessary hydrological analysis in connection with river basin, dam/ reservoir design and Irrigation water requirement.

3.3.5 Land Surveyor Expert

Qualifications: The expert shall have documented experience in topographical land surveys and thematic mapping digital thematic and GIS based experience in similar large projects. He/she shall have a minimum BSc degree/Advanced Diploma qualification in land survey and have a minimum of 10 years overall experience and at least 5 years relevant GIS experience in similar assignments. He/ She must be conversant with the use of GNSS data collecting system and production of maps using AutoCAD Civil 3D software for the design of irrigation projects. He/She will perform the below tasks:

a) Review available maps and survey data for the project area;
b) Prepare a Base Map showing the delineated proposed Service area, Drainage area, and the location of the headwork's axis drawn/marked thereon. The Northings and Easting's recorded thereon must use UTM Arc 1960 as reference Datum;
c) Prepare write-up/ scheme of work of Dam axis, Canal line and other surveys from which the Scheme of Development of the project shall be based;

d) Monitor the conduct of survey works such as Topographic survey of Dam or Reservoir, Farm and its related Infrastructure, and the Establishment of Horizontal and Vertical Control based on UTM Arc 1960 Datum;
e) Prepare the Topographic maps, Profiles, and Cross-Sections based on the format as agreed by NIRC;
f) Undertake other tasks/activities assigned/delegated by the Team Leader as may be required during the conduct of the Study.

3.3.6 Geotechnical Engineer

Qualifications: The Geotechnical Engineer shall be a registered professional Civil Engineer with a Master degree in Geotechnical subjects and proven experience in geotechnical investigations and analysis including safety aspects in the context of planning and design of Dams and command areas. He/ She shall have a minimum of fifteen (15) years overall experience and ten years (10) years relevant experience including surface exploration of physical conditions of sites, geophysical methods, and sub-surface investigations.

Responsibility: The geotechnical engineer shall be responsible in;

a) Conducting surface exploration of physical condition of site.
b) Conducting the sub surface investigations.
c) Participate in designing and/ or design review of dams, channels, slope stability, hazard assessments and project implementation planning.
d) Identification of possible constrain of the site and location of borrow pits and,
e) To perform other responsibilities as assigned by Team leader/ Assistant team leader.

3.3.7 Economist/ Financial Expert

Qualifications: The Economist shall have a minimum Master degree qualification in economy. The Economist shall have a minimum of ten (10) years overall experience and five years (5) years relevant experience. Shall have proven experience in the economic analysis related to construction of large multi-purpose schemes and, cost benefit analysis, and multi-purpose benefit modelling of water projects including economic benefits attributed to irrigation development, tourism, water supply for domestic and economic uses.

Responsibility: The Economist shall be responsible in;

a) Conduct surveys.
b) Collect and analyze data.
c) Interpret data and determine economical viable of the project

d) To perform other responsibilities as assigned by Team leader/ Assistant team leader.

3.3.8 Safeguard or Environmental Specialist

Qualifications: Safeguard or Environmental Specialist shall have a minimum of master's degree in either Environment, Environmental engineering, Natural Resources Management, or related field and with at least cumulative experience of ten (10) years of practical working experience in undertaking ESIA studies or other related projects. In addition, He/ she must be familiar with the Tanzania Government Environmental laws and regulations, environmental policies and procedures and must be registered as EIA Expert with NEMC.

3.3.9 Quantity Surveyor/Cost engineer

Qualification; The expert should have degree/ Advanced diploma with at least five professional experiences in at least four (4) projects in the preparation of quantity and cost estimates of civil works in the same or similar works.

Responsibility: The expert will cover the following: -

a) Establish or undertake the review/updating of cost estimates considered in previous studies; Gather unit costs of construction materials or construction costs in the project area;
b) Prepare unit price analysis of various construction pay items of works specific to the project area;
c) Prepare the quantity and cost estimate of civil works and other components of the project during the master planning and feasibility stage;
d) Undertake other tasks/activities assigned/delegated by the Team Leader as may be required during the conduct of the Study.
e) Undertake other tasks/activities assigned/delegated by the Team Leader as may be required during the conduct of the Study.

3.3.10 Electromechanical Engineer

Qualification; The expert should have Bachelor's degree in Electromechanical Engineering, Mechanical Engineering, or a related field; Master's degree preferred. Proven experience in electromechanical system design and development, with a minimum of ten (10) years overall experience and five years (5) years of relevant work experience.

Responsibility: The expert will cover the following: -

a) Produce electrical, electronic, or mechanical drawings or other related documents orographic necessary for electromechanical design in the dams

b) Translate electromechanical drawings into design specifications, applying principles of engineering, thermal or fluid sciences, mathematics, or statistics
c) Analyze engineering designs of logic or digital circuitry, motor controls, instrumentation, or data acquisition for implementation into new or existing automated, servomechanical, or other electromechanical systems.
d) Determine whether selected electromechanical components comply with environmental standards and regulations
e) Design and develop products and systems like cables, connectors and penetrators.
f) Prepare guidelines and procedures to use during implementation and after implementation products as per specifications and schedules using safest and cost-effective processes.
g) Examine, prepare and verify technical drawings and specifications of electrical systems, to ensure that installation and operations conform to standards and client requirements.
h) May draft detailed multi-view drawings of assemblies and sub-assemblies.
i) Analyze engineering sketches, specifications and related data and drawings to determine design factors
j) Modify design to correct operating deficiencies and/or reduce production issues.
k) Undertake other tasks/activities assigned/delegated by the Team Leader as may be required during the conduct of the Study.

3.4 Estimated Staff Months

The Consultant shall draw up a team of key personnel for Conducting Feasibility study, Detailed engineering design of dams design, Flood modelling, Environmental and Social Impact Assessment for the flood management works in Kinyasungwe Sub Catchment Area.

In addition to the above key staff the Consultant shall determine the Support and Backup staff deemed necessary to assist for successful completion of the assignment. However, their qualifications will not be considered in the evaluation of the proposals. The numbers of staff are only indicative requirements; the Consultant will determine the staffing in accordance with the required duration to implement efficiently the requested tasks. The estimated minimum level of effort from consultant is as shown in table 1;

Table 1: Number of months for each key staff

SN	Team member	Staff	Months	Total
1	Team Leader	1	6	6
2	Deputy Team Leader	1	4	4
3	Dam Engineer specialist	2	2	4
4	Civil/ Irrigation/Structural Engineer	2	2	4
5	Land Surveyor	2	2	4
6	Geotechnical Engineer	2	1	2
7	Economist/ Financial Expert	1	1	1
8	Hydrologist	2	1.5	3
9	Safeguard Specialist (Dam safety Engineer)	2	1	2
10	Environmental Expert	2	1	2
11	Sociologist Expert	1	1	1
12	Electromechanical Engineer	2	1	2
	Total Man-Months			**35**

3.5 Recruitment of Consultant. The consultants would be recruited using the quality-based procedure (QBS) and the international firms would participate in the bidding. The international firms would be encouraged to make joint ventures with the national firms and institutes for carrying out this assignment. A short list of the qualified firms would be prepared and the technical and financial proposals would be invited for the Assignment at the same time.

3.6 Procurement of Goods. Purchase of heavy-duty laptops, printer, plotter and software will be carried out according to the need of consultants using their own budget and cost included in the financial proposals. The Consultants shall maintain inventory list of all purchased items and submit details in quarterly reports. All these items shall be returned to National Irrigation Commission upon completion of contract with fair wear & tear condition.

4.0 Duration of the Assignment

Within a maximum of six (6) months from the date of contract signing or the Receipt of the Notice to Proceed (NTP), whichever comes first, the Detailed Engineering design must be completed. The cost of completing this activity will be established by the submitted and authorized financial proposal.

5.0 Reporting Obligations and Payments

5.1 Payments

The consultant will be responsible to the National Irrigation Commission who will form a Technical Committee to review the reports and advise him/her accordingly. The consultant shall present and submit to the client hard and electronic copies of the reports discussed below in English, in a format to be agreed. The consultancy contract will be a lump sum contract against submitted and approved deliverables, as per the following disbursement schedule:

a) Twenty- Five (25) percent of the contract price shall be paid upon submission of the acceptable inception report **(within 30 days from the date of contract signing);**

b) Twenty-Five (25) percent of the contract price shall be paid upon submission of the acceptable Feasibility Study Report **(within 90 days from the date of contract signing);**

c) Thirty (30) percent of the contract price shall be paid upon submission of Draft Detailed Engineering Design Report, Drawings, Bill of Quantity, Cost Estimate and Tender document **(within 150 days from the date of contract signing)**; and

d) Twenty (20) percent of the contract price shall be paid upon submission of acceptable Final Detailed Engineering Design Report, Construction Drawings, Bill of Quantity, Cost Estimate and Tender Document **(within 180 days from the date of contract signing).**

5.2 Reporting Obligations (Deliverables)

The National Irrigation Commission (NIRC), which will establish a Project Implementation Team (PIT) to examine the reports and provide the consultant with appropriate advice, will be the consultant's ultimate accountability. The consultant will deliver hard copies, softcopy and electronic files of the reports listed below in English to the client.

i.) Acceptable Inception Report.

After contract award, the Consultant shall provide five (5) copies of the inception report within Thirty (30) days from contract award. The report will include an overview of the Consultants' organization, work program (including a comprehensive work plan), methodology, workforce involvement timetable, reporting schedule and Flood model analysis of Kinyasungwe sub-Catchment area.

ii.) Acceptable Feasibility Study Report.

Five (5) copies of the Draft feasibility report of the dam must be turned in within one hundred and twenty (120) days of the contract signing date. In order for the consultant(s) to take the client's feedback into account and move forward with the final Detailed Engineering Design stage of the report preparation.

iii.) Acceptable Detailed Design Report

The submission of the Final Detailed Design Engineering design report and five (5) copies of the tender documentation for dam projects is required within one hundred and eighty (180) days of the contract signing date. The structural calculations, cost estimates, drawings, financial and economic analysis, tender documents, implementation timetable, and construction plan are all required to be included in the report.

6.0 Record of Documents

The original documents must be delivered to NIRC Headquarters in hardcopy and softcopy in an External Drive compatible with the software used and approved by the client, such as AutoCAD, Microsoft Word for word processing, Microsoft Excel for spreadsheets, and Microsoft Project for project management e.t.c after all final documentation has been delivered. The consultant is required to submit all reports and communication materials created to the NIRC Headquarter.

Annex 1: Location Map and Aerial View

Figure1-1: Map of Kinyasungwe Catchment Area