Terms of Reference

For Feasibility Study, Detail Design and Tender Document Preparation of Flood Risk Reduction Investment for Omo-Gibe Basin

September 2024

Addis Ababa
Ethiopia

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1. Context

The government of Ethiopia (GoE) has an existing pipeline of prospective flood risk reduction projects. Under a previous consultancy assignment, a review of several proposed projects was undertaken. In terms of project preparation, including the master plan document, this consultancy service will define major sub-projects in protect areas across several Woredas involves the construction of river dykes as a primary flood risk reduction element.

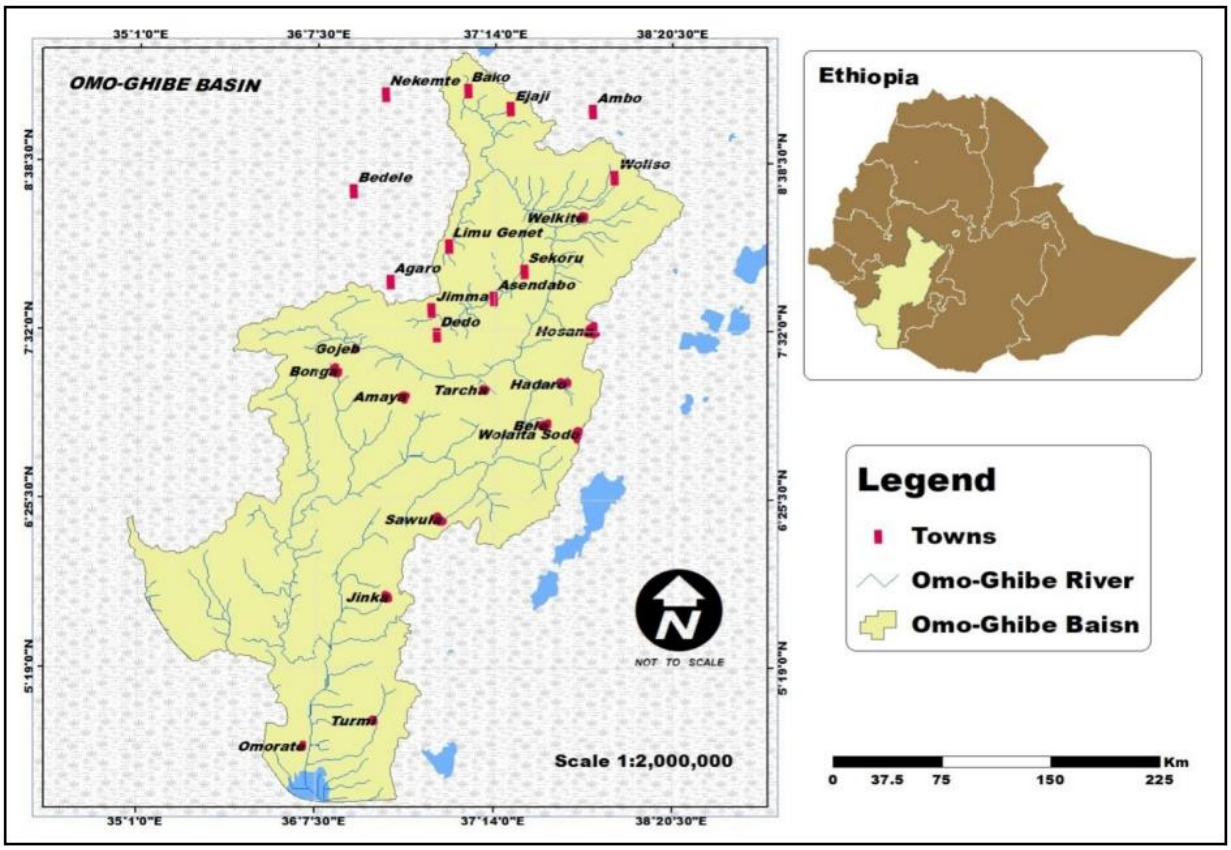

Figure 1 1: Map of Omo-Gibe Basin, Ethiopia

A technical review of the hydrological and hydraulic analysis underpinning these projects highlighted several aspects that would require further consideration before a detailed design of flood risk reduction and associated infrastructure can be finalized, including:

1) Data collection - Site-specific data collection, including hydromet data, terrain data, to be collected. Field surveys and observations may be needed to strengthen the data basis for further detailed studies.

2) Hydrological and hydraulic analysis Detail on design rainfall estimation, critical storm duration, rainfall-runoff model development, calibration and method selection, as well as extreme value analysis and flow reconciliation will be required to support a robust feasibility stage assessment. If necessary, associated hydraulic modelling to determine the areas benefiting from the scheme and the standard of protection afforded.
3) Consolidated and auditable reporting trail
   - the treatment of observational data used as inputs, including gap filling techniques
4) justification of model parameters, including robust and rigorous calibration and sensitivity testing
5) Explanation of how rainfall-runoff models were used for the analysis and how the inflows to any hydraulic models were derived from the hydrological results.
6) Inclusion of climate and other future changes into the project feasibility design process.

Any one of several aspects of the analysis carried out to date may include important elements that have been based on questionable input data, statistical analysis or modelling approach, which may undermine the validity of the designs.

2. Purpose

The purpose of this Terms of Reference (ToR) is to invite service provider consultancy firm to submit technical and financial proposal for the Feasibility Study, Detail Design, and Tender

Therefore, this ToR is intended to provide guidance to interested consultant on the scope of services, deliverables, and requirement to be met the bank standard and duration of the consultancy period.

In addition to the primary objective of delivering a technically sound design basis, there is a capacity building opportunity that can be capitalized upon.

For future flood risk reduction scheme designs, it is important the Ministry of Water and Energy (MoWE)/BDO utilize best practice methodologies in terms of data preparation, hydrological and hydraulic modelling methodology, calibration, and sensitivity testing. This TA is expected to be delivered in collaboration with MoWE/BDO, responsible for the original work, following best practice approaches. In doing so, practical hands-on training for Ethiopian water engineers will

be carried out ‘on-the-job’ by technical staff executing some of the work in parallel with the consultant. This will be consolidated into a training workshop at the conclusion of the TA, to further consolidate and transfer the skills and knowledge needed to execute or review similar analysis to be carried out on future flood risk reduction projects.

The study will include the conceptual design, detailed design, and preparation of bidding documents for the procurement of construction services for selected physical investments. The focus is on developing strategies to mitigate flood risks within the specified basin.

- Conduct a thorough Feasibility Study to identify flood-prone areas, assess potential impacts, and propose feasible mitigation measures.
- Develop a detailed design that encompasses engineering, environmental, and social considerations for the identified flood risk reduction measures.
- Prepare comprehensive Tender Documents, including technical specifications, cost estimates, and project timelines, to facilitate the procurement process

3. Introduction

The Omo-Gibe River course is entirely contained within the boundaries of Ethiopia, and border with Kenya. It is the principal stream of an endorheic drainage Basin; the part that the Omo-Gibe River drains include part of the Western Oromia Region and the middle of the Southern Nations, Nationalities, and People's Region. The Omo-Gibe River Basin has an area of 79,000 km2, covering of the 75.5% of its area in SNNPR and 24.5% in Oromia (Figure 1). The Omo-Gibe River drains to the south from Ethiopia’s humid highlands of Kaffa and West Shoa zones to arid lowlands of South Omo zone terminating in the Omo-Delta passing through undulating gorges of Dawuro, Gurage, Wolaita and Hadiya zones.

The River Network of Omo-Gibe River Basin is considered as a very significant resource in Ethiopia as it carries the second largest annual runoff (next to the Blue Nile River Basin) of any river system in Ethiopia (Woodroofe et al, 1996). The Gibe River rises on the Ethiopian Plateau just north of latitude 90 N at an elevation of about 2200 m. There are some important tributaries, but the general direction of flow of the river is southwards towards the Omo River trough, a fault feature. During the African Pluvial Periods, the Omo-Gibe River formed a deep gorge from which it emerges at about latitude 60 30' N.Gibe River is called the Omo River in its lower reach, south, and south westwards from its confluence with the Gojeb River. The northern part of

the catchment has a number of tributaries from the northeast of which the largest are the Walga and Wabe Rivers. These drain land, which is largely cultivated, much of it with impeded drainage and where erosional processes are important. The Tunjo and Gilgel Gibe Rivers are important rivers, which also drain mainly cultivated areas to the north-west, which have more permeable soils than those of the Walga and Wabe catchments.

All these rivers drain ultimately into the upper Gibe River (MoWE, 1996). The Gojeb River is a major right-bank tributary to the Omo River, draining the uplands that have been less intensively cultivated than other parts of the Basin. Thus, it drains most of the western extension of the Basin, including much of the area of highest rainfall but also the area with the most complete natural forest cover. To the south of the Gojeb are the catchments of the Sherma, Guma and Denchiya Rivers, tapering streams that join the Omo at the northern end of the flood plain. Except in the very driest years, these rivers are expected to maintain some flow throughout the year. The Sana, Soke, Deme, and Zage Rivers drain the uplands on the eastern side of the middle and lower Omo-Gibe catchment where the rainfall is relatively high. These rivers are believed to be perennial.

The water resources of the Basin are large and, largely, are under-utilized, for which there are a number of reasons: physical, temporal, spatial, and economic. Currently there is very little regional development of ground water resources within the Omo-Ghibe Basin. Assuming that 10% of the available recharge can be obstructed, the total ground water potential that may be developed is estimated to be 1.0 x 109 m3 /year (EWSS, 2001).

4. Rationale of the Project

- Spatial and Temporal variation of rainfall, high rainfall on upper side of the Basin with big flood impact at middle and lower Omo Basin
- Highest inflow vs relatively low irrigated land with low abstraction
- Shallow activities related to flood risk reduction and associated infrastructures in order to safeguard the assets and life of the community and business sector that depends on recession agriculture and river related life

5. Scope of Work

This Terms of Reference outlines the tasks, timeline, and expectations for the consultancy service. The consultant is expected to deliver a thorough basin-level study, prioritize investments, and provide detailed designs and bidding documents for physical flood risk reduction measures with nationally and internationally known and bank accepted standards.

The consulting firm shall carry out the following tasks:

- ✓ Task 1: Inception
- ✓ Task 2: Data collection, data Audit, Analysis, and Survey
- ✓ Task 3: Update of Hydrological and Hydraulic Analysis
- ✓ Task 4: Identify Multiple Options and Select Recommended Option
- ✓ Task 5: Hydraulic Modeling and Hazard Mapping
- ✓ Task 7: Detailed Design and Tender Documents
- ✓ Task 8: Training and Capacity Building

Task 1: Inception

At inception, the following streams of work shall be mobilized:

a) Stakeholder engagement mapping and security planning: Working with the client, a stakeholder map and plan will be developed outlining goals for the engagement and a schedule, including proposed methods. Security concerns must be scoped and addressed in a risk assessment

b) Thorough technical review of all existing feasibility, modelling, data and detailed design reports for work carried out to date

c) Reviewing available literature and studies in order to locate and map areas with a history of flooding.

d) A high-level screening and assessment of available data and refinement of approach: all the main analytical and modelling methods required for studies, the associated data needs and options, and the impact that each will have on accuracy and robustness. To facilitate this, the GoE will facilitate a technical workshop between the consultant and relevant technical staff from the government to allow the consultant to familiarize themselves with the data, available models and key staff

e) Preparing an „Issue analyses" for each location, of the type of flooding (riverine, urban, depression, storm surge, etc.,) and nature (magnitudes and frequency) of the floods and the causal factors aggravating their impacts.
f) Risk Assessment and Identification
g) Preparation of a detailed methodology and program for all of following tasks
h) Development of a refined integration and training plan including secondment, workshop and training components, to be implemented through the project in order for the GoE (see task 3 for further details)

. **Task 1 deliverables:**

A draft inception report including (1) a stakeholder engagement mapping and an overview of data availability, highlighting key issues and possible data improvement strategy; (2) a detailed review of existing models and suitability for forthcoming tasks, as well as a proposed methodology with suggested additional or change in modelling software to be used; (3) a plan for each of consultation actions, program, risk and data management plans; and (4) a revised integration and training plan summary and actions.

Task 2: data collection, data Audit, further Analysis and Survey

This task addresses any requirements for data collection to facilitate the completion of the hydrological and hydraulic modelling required in subsequent tasks. Specifically, the requirements are to:

a) Collect any necessary and relevant data
b) Evaluate and test the validity of input data utilized and assess need for data collection and field surveys, with regard to observational data sets
c) Assess the completeness of terrain data sets used and/or available to the detailed studies and develop and execute a topographic field survey program that will deliver terrain data that can be utilized for detailed flood risk and dyke alignment studies
d) Collect and collate information of the storage and operation of all relevant existing and proposed reservoirs that may relate to the design of the river protection or future operational and irrigation considerations of the river protection infrastructure
e) Evaluate any areas of data analysis that need to be revisited, and carry out the necessary reanalysis

f) Develop draft scope for technical implementation of required field surveys
g) Conduct agreed additional surveys
h) Review and quality assurance of deliverables of field surveys

The subtasks are intended to be executed with the engagement of key technical staff form MoWE and the Basin development offices. **Task 2 deliverables:** required outputs include (1) data availability report, (2) technical scope for required field surveys, (3) results of field survey, and (4) Inventory of all data, collected, refined, and obtained through field survey

Task 3: Update of Hydrological and Hydraulic Analysis and Setting Target Flood Events and Sites

In order to reassess the existing work, this task is to be commissioned with the full engagement of the MoWE/Basin development offices technical team. This is necessary, given that the report products themselves do not contain important detail on the data and methods used in order for the consultant to replicate the work done. Secondly, this will facilitate the scoping of a capacity building and train task (i.e., task 7) that will follow.

The analysis done so far is to be used as a basis and additional work on the following aspects is required:

a) Report/provide details on the methodology (including justification) used for the design rainfall depths. Consideration should be given to using a consistent approach to deriving depth duration curves, or intensity duration curves, as this is pertinent to all studies. Uncertainties and limitations need to be acknowledged
b) Sensitivity analysis to determine critical storm duration for the study catchments. For dam studies this is very important as lag time changes with dams in place and this would need to be explicitly accounted for
c) Provide detail on rainfall-runoff model development for design flood estimation and dam feasibility. Specific reference to methods selected (e.g within HEC-HMS) should be made. Use methods appropriate to event modelling as opposed to continuous simulation
d) Flood frequency analysis: Provide detail/statistical measures of goodness of fit to justify selection of distributions, consider hydro chronology to extend systematic record and carefully approach reconciliation between statistical estimates and design floods derived

from the rainfall-runoff models at key locations. Effects of climate change will be considered

e) Consider using consistent approaches to flow validation for ungauged catchments (consider donors/empirical methods)
f) Consider volume-driven mechanisms of flooding given the size and floodplain in the lower part of the catchment
g) Extend hydrological modelling where appropriate to include additional upstream and downstream areas (e.g., wetlands and reservoirs, including operations of reservoirs both existing and considering proposed dams and reservoirs)
h) Probable maximum Precipitation (PMP) analysis: Harsh field method is typically considered a preliminary approach to PMP derivation. Consider using a more comprehensive approach either in conjunction with design rainfall generation for the catchments and/or independently based on international best practice
i) Consider joint hydrologic-hydraulic modelling calibration or as a minimum validate flows with testing through hydraulic model. There may be a need to check or re-visit the flow estimates after a trial application to the model
j) Develop baseline 2-dimensional flood maps for return periods from 2- to 1500- years
k) Setting target flood event (e.g. return period) considering balance between urban/rural and consistency among upstream/downstream through consultation with MoWE and WB
l) Identify/confirm target sites (locations) of flood risk reduction sub-project based on risk information and socio-economic conditions. Target sites of existing studies, if available, will be referred appropriately
m) Write a report that documents methods, calculations, and decisions made. The work needs to be documented in a manner that is auditable

The hydrological analysis should be linked to a reassessment of the area protected by the proposed project using a suitable hydraulic model and the standard of protection afforded carried forward to update the assessed benefits.

Task 3 deliverables: A complete delivery of the technical report, paying particular attention to the points above. The report should be thorough in its documentation of data treatment, methods, and outputs in manner, which enables future replication of the work.

Task 4: Identify Multiple Options and Select Recommended Option

The consultant will compare at least three options near the target location and recommend the best one based on the interim studies for detailed design and cost. The option will be prepared considering multipurpose options infrastructures for long serving (wetland, retention pond, dyke) and suitable, type, site, size, beneficiaries, energy efficiency and other conditions.

The consultant will prepare a set of criteria and a table comparing the options in terms of, including but not limited to flood risk reduction effects (including quantity of beneficiary people and land), multi-sectoral co-benefits, adaptation to climate and other changes, O&M, cost benefit analysis, dimensional parameters (height, reservoir area and volume), preliminary cost estimates (investment and O&M), and preliminary environmental and social impacts. The consultant shall validate the results of conducted studies/investigations/tests.

This is an opportunity to optimize the project costs and to ensure the design is based on good practice design principles. As a minimum, this task should consider:

General layouts of scheme and alignment of the proposed infrastructure:

For example, to ensure;

i. the dyke alignment continues to make space for the river where appropriate (to reduce both the impact on the hydrological processes but also reduce the construction costs) and
ii. The dykes are proposed only where necessary to minimize the over length of the dyke (and reduce cost) without compromising protection.

Design for exceedance: design the dyke to ensure continued performance when loads exceed the design level.

Multi-functionality and co-benefit: plan and design of associated infrastructures such (but not limited to) bridge, road, and irrigation/intake facilities, access routes for pastoralist and public access to rivers, community pond, in consideration of feedback from local government and communities received through existing studies and further consultation through this study.

Appropriate and ssustainable materials: consider the opportunity to use sustainable material and construction methods that can be sources locally. Locations, quantities, and transport plan of all locally obtained materials (e.g. materials for dike construction) shall be prepared, which will

inform the bidding document. Provide an initial assessment of the whole life costs of the constructing, maintaining and replacement of the dyke to ensure the project is variable on a whole life perspective.

Climate change influence: explore how the scheme options performance in alterative climate futures, including extreme heat (and the impact on embankment materials) as well as extreme flows (for example).

Consider the morphological processes: Ensure the design appropriately accounts for expected morphological change, and any issues for attention in the next stage of design flagged (and factored into the cost estimates)

Exploit opportunities to utilize nature-based solutions: Ensure the design appropriately examines and identifies opportunities to incorporate nature-based and hybrid solutions for both flood risk reduction and ecological enhancement, using quantitative assessment where possible to fully account for co-benefits arising for using such design elements.

The assessment should understand these contributions and modify the conceptual design appropriately to reduce project costs whilst continuing to appropriately manage risk. The consultant is encouraged to propose a multi-criteria analysis or similar framework in which to assess the different design considerations in a clear, transparent, and quantitative manner. Any such framework should draw upon the outcomes of stakeholder engagement through the assessment process, with a consultation workshop at the start to determine the design criteria, and co-design workshop to elicit feedback and ideas from Basin managers and relevant stakeholders.

Task 4 deliverables:

1. Identification of at least three options for each target site with clear concept, multi-criteria comparison, and rationale for recommended option
2. Two workshops, first of which to develop assessment criteria and understand constraints and concerns with the second as a co-design session presenting the proposed design concepts and consider feedback,
3. Final design concept of recommended option, and

4. Recommendations for additional feasibility-level investigations/assessments and detailed design requirements.

Task 5: Hydraulic Modelling and Hazard Mapping

Flood hazard maps will be produced at high a resolution as possible given the modelling output resolution, but as a minimum, will be of sufficiently high resolution to identify hot-spots and understand which areas/communities or specific features of assets will be most affected by floods (expected to be 30m or higher resolution).

The hydrological and hydraulic modelling for the flood hazard and risk assessment must consider the interaction of Main River flooding for the primary flood risk reduction structures. However, pluvial flooding is also expected to be considered with respect to urban and rural areas within the areas benefiting from the primary flood protection structures. The modelling exercise will consider both fluvial in isolation and the joint probabilities of these different sources of flooding, assessing the level of dependence between the flood mechanisms based on available data and the knowledge of the hydrologic/hydraulic system in general. A range of return periods will be modelled, within a range of two to at least 1000-years for both pluvial and fluvial flooding (to be finalized during inception) for all scenarios.

The consultant must propose an appropriate rainfall-runoff methodology for the various catchment areas to define extreme discharge events. The methodology must address all aspect outlined in Section 1 of this ToR and the consultant’s own observations from its review of previous work. This approach must account for the catchment characteristics, include parameters with a clear physical base in the simulation of soil moisture, and flow routing to allow a straightforward representation of land use changes and human interventions, as well as applications to ungauged areas. The modelling must be applied to realistically represent variations in rainfall, topography, soil type, land use, and adequately simulate floods' genesis.

Hydrological model must be carried out using industry standard methods and software, and parameters and inputs will be based on and calibrated against the best available information and local data (i.e. flow and rainfall records/statistics). The final values must be discussed and agreed upon with the client and stakeholders. Hydraulic modelling will be carried out using industry standard software, which must be freely available and supported for the near future to allow

suitably qualified and experienced personnel to repeat or extend the work carried out under this assignment.

The modelling must be carried out in order to determine the concept designs for the primary flood protection structure, including an optimized dyke alignment. This optimization should significantly improve upon the existing schematic alignment produced by previous studies, and should incorporate design elements (including NBS, etc.) based on the outcomes of task 4. In the way, the concept dyke design determined by this analysis will consider local-scale terrain, land use, infrastructure, existing wetlands and so on. Opportunities for ecological enhancement and utilization of nature-based solutions should be considered (and will be reviewed in task 7) consultant shall select and use a basin Model to be used as a flood-specific. The goals are to address flood prevention, protection, and mitigation and to enhance preparedness thereto.

Task 5 deliverables: (1) a draft Hazard modelling and Results Report including an updated understanding of the flood hazard within the study area, providing understandable communication products, such as maps and graphical representations of the current and future hazard for different return periods and under different climate change and land use scenario and (2) a comprehensive database with all hydrological and relevant modelling data collected or developed during the task, including maps and appropriate metadata; and (3) an optimized infrastructure (dyke, wetland, retention ponds etc..) alignment with sufficient detail to determine high level costing, along with associated concept design drawings; and (4) hazard maps before and after investment of the above infrastructure.

Task 6 – Application of Flood Risk Reduction Investment Framework

A strategic investment framework for flood risk management in Ethiopia was developed for EFMP. The use of the framework in this TA is seen as an appropriate application of this new strategic tool. The risk-based framework utilizes a range of qualitative and quantitative appraisal metrics to assess and rank proposed projects to determine a strategic investment plan in a given geographical or administrative area.

The framework can be applied to both a range of proposed flood risk reduction projects, as well as to define the baseline flood risk nationally, at Woreda-level. The framework has been applied to the all over projects, based on the original feasibility studies provided to an earlier consultancy

project. The framework is therefore expected to provide both a starting point and a means to execute this flood risk assessment. Based on the new flood hazard modelling, an update to the investment case is to be undertaken.

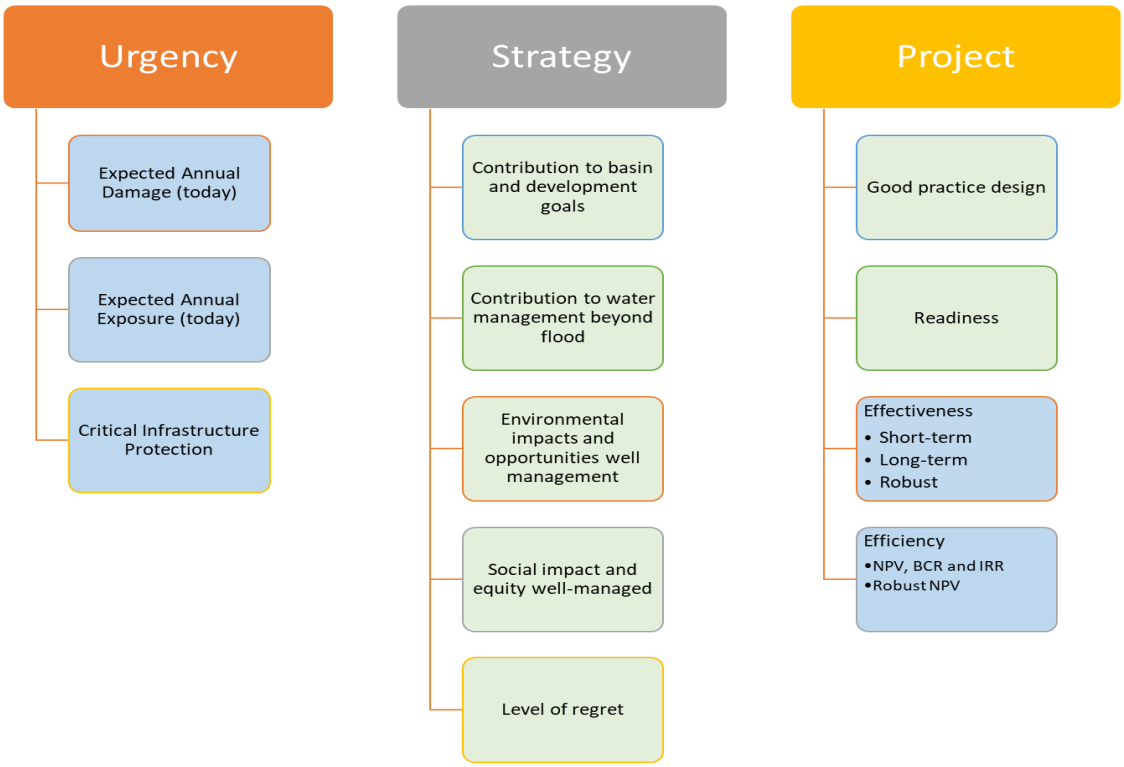

Figure 1 2: Overview of the strategic flood risk reduction investment framework recently developed for the GoE

Task 6 deliverables: A brief assessment report, utilising the principles, methodology and structure of the Strategic Investment Framework for Flood Risk Reduction in Ethiopia.
Task 7: Detailed Design and Tender Documents

Through Tasks 4, 5 and 6, the concept deign is expected to be refined/completed to a point where optimization of the river protection schemes are achieved, and detailed design can be formalized. The purpose of task 7 is to support the procurement of design and construction services following World Bank procurement guidelines and utilizing the appropriate templates[1]. After prequalification, a two-stage bidding process is expected to be the appropriate procurement process for the flood risk reduction civil works proposed given the scale and complexity of the assignment. First, unpriced technical proposals based on a conceptual design or performance specifications are invited, subject to technical as well as commercial clarifications and

[1]https://pubdocs.worldbank.org/en/789731605891971820/SBD-WORKS-SEA-SH-January-2021.docx

adjustments, to be followed by amended bidding documents and the submission of final technical and priced bids in the second stage.

To facilitate the procurement process, the consultant is expected to provide bidding documents (including Bill of Quantity (BOQ)) to furnish all information necessary for the prospective bidder to prepare a bid for the goods, works, design and other non-consulting services to be provided, including:

Invitation to bid and instructions to bidders;

- Contractual terms and conditions;
- Specifications and concept drawings based on the refined and optimized design achieved through the design process carried out through Tasks 5, 6 and 7;
- Develop an inventory or relevant detailed technical data (including geological and environmental data, logs and surveys);

Bidding documents shall be worded clearly and precisely. They should state the work to be carried out, the location of the work, the goods to be supplied, the place of delivery or installation, the schedule for delivery or completion, minimum performance requirements, and the warranty and maintenance requirements, as well as any other pertinent terms and conditions. The documents should encourage both national and international competitive bidding. The bidding documents shall define as necessary the tests, standards, and methods that will be employed to judge the conformity of equipment as delivered, or works as performed, with the specifications.

Task 7 deliverables: A draft set of bidding documents consistent with World Bank procedures and guidelines to be used for international bidding on the proposed river and associated works. Volume of the task is tentatively estimated based on existing two studies described in the context and might be changed upon deliverables of previous tasks.

Task 8: Training and Capacity Building

This will be executed through a policy and gap analysis of existing planning and Integrated Flood Risk Management (IFRM) practices and policies enabling strategic planning. This will include identifying the roles in which institutions play in implementing planning and IFRM in Ethiopia. The project also intends to strengthen Disaster Risk Management (DRM) coordination

among federal level agencies and between federal and regional level governments as well as to build the capacities of the DRM offices in regional governments to be able to better implement local level Disaster Risk Management initiatives.

There is a perceived opportunity for strengthening the GoE capacities, knowledge, and skills in executing the risk-based analysis needed to implement IFRM. The content of the training component should focus on contemporary thought with regard to best practice IFRM from hazard mapping, the selection of physical measure options (including Nature-Based Solution such as retention ponds, wetland improvement), design standards, O&M considerations, community engagement for physical planning and so on.

The capacity building will then be executed through a series of workshops and training of relevant stakeholders identified in the screening exercise. The workshops are expected to focus on themes identified through the screening exercise and based on the consultant's experience and expertise. At the outset, the content of the workshops is expected to include (though are to be refined or revised under this task):

a) risk-based approaches for flood risk strategic investments – aimed at spatial analysts, geographic information system technicians to imbed hard skills, tools and methodologies behind the strategic investment framework
b) facilitation workshop among federal level agencies and between federal and regional level governments to build the capacities of the DRM offices and Basin management authorities

Subtasks are therefore:

- Screening of institutional awareness and capacity to utilize risk-based approaches in IFRM and strategic planning.
- Based on this screening, develop stakeholder engagement, and training program, expected to consist of three 3-day workshops.

Deliver training and capacity building workshops.

Task 8 deliverables: Development of draft review report consisting of observations of needs and recommendations to address strengthening (1) institutional technical capacity to utilise risk-based approach to flood risk reduction, (2) developing appropriate training program and materials, and (3) conducting training program in cooperation with the client and producing a

report on capacity development activities. The trainees assumed around 60 and the cost of venue covers by consultant.

6. Duration of Contract and Deliverables

The implementation schedule stated in contract agreement the consultant will be required to submit reports. The following are the deliverables:

Table 1.Duration and deliverables

S.no	Tasks	Descriptions	Deliverables to be submitted to MoWE	Due	Remarks
1	Kick off meeting		-	Within 1 week from signing of the contract	To ensure proper inception
2	Inception report	✓ Shall include thorough review of existing studies, as well as several dam projects, which is time consuming ✓ To ensure appropriateness of consultancy's inception works, we could organize kick off meeting.	See detail under task 1	1 month from signing	
3	Data audit, analysis and survey		See detail under task 2	2.5 months from signing	
4	Update of hydrological and hydraulic analysis and setting target flood events and sites		See detail under task 3	4 months from signing	
5	Identify multiple options, select recommended option, and conceptual design covering associated infrastructures	✓ Requires stakeholder consultations including community engagement	See detail under task 4	7 months from signing	
6	Hydraulic modelling and		See detail	8 months Can be	

	hazard mapping		under task 5		done in parallel	
7	Application of Flood Risk Reduction Investment Framework		See detail under task 6	9 months		
8	Detailed Design and Tender Documents		See detail under task 7	10 months		
9	Training and Capacity building	✓ This task should be conducted throughout the consultancy, in align with each deliverable. ✓ Plan for training and capacity building should be approved at the inception stage, and the consultant should identify several milestones. ✓ Final deliverable is almost at the end of the consultancy.	See detail under task 8	Submit training and capacity development plan at inception stage, which identifies milestones. Final report by the end of consultancy (12 months from signing).		

The total duration for completing the Feasibility Study and Detail Design shall be **twelve (12) months**, which will start from the day the consultant commenced the services.

7. Roles and Responsibilities

7.1 MoWE has the following responsibilities:

- Provide all reports, data, and maps of relevant previous studies at the beginning of the consultancy;
- Provide access to the project site;
- Schedule and facilitate meetings with partners' organization upon request by the consultant;
- Facilitate the stakeholder participation in situation assessment and preliminary planning and design;
- Pay the consultancy fee according to agreed mode of payment;
- Resolve any social problem whenever it arises;
- Organize a discussion forum among stakeholders and concerned institutions in order to evaluate the proposed planning and detail design;
- Make comments and feedback on design report and check their incorporation or notice of acceptance of justification for rejection;
- Notify the consultant either to proceed with the subsequent work according to plan or to make modification whenever it deemed necessary;

7.2 The Consultant firm has the following responsibilities:

- The consultant shall demonstrate its in depth knowledge, skill understanding and experience of Omo-Gibe Basin social, economic and environmental context
- Prepare detail and comprehensive technical proposal indicating overview of the Basin situation assessment concerning this term of reference, approach, and methodology of the study, level of investigation and study, sampling and data analysis, schedule of activities and financial plan
- Undertake desk study (document review), prepare strategic plan, study and analyze information and data, investigation surface and sub-surface condition, and submit feasibility report
- Submit preliminary planning and design report, draft detail design report and final detail design report and engineering/construction drawing album
- Prepare Tender Document and Technical Specification

8. Manning Schedule

The consultant shall indicate the detail-manning schedule corresponding to the required expert mix

9. Man Power Requirement

The consultant must have the following mix of experts and shall establish task teams for Omo-Gibe Basin for effective implementation.

- ✓ Lead flood risk management Expert (Team Leader)
- ✓ Senior Hydraulics Engineer
- ✓ Senior Hydrologist
- ✓ Dam operation Expert
- ✓ Water Resource/Irrigation Engineer
- ✓ Structural Engineer
- ✓ Infrastructure Engineer
- ✓ Environmental safeguards specialist
- ✓ Social safeguard specialist
- ✓ Mechanical Engineer
- ✓ Geotechnical Engineer
- ✓ Geologist
- ✓ Surveyor
- ✓ Quantity surveyor
- ✓ GIS expert

Table 2.Table Consultant key expert requirement

s. no	Required Key experts	Required Number	Qualification	Relevant experience
1	Lead flood risk management Expert (Team Leader)	1	Bsc or above in flood risk management, hydraulic engineering, hydrology, water resource engineering, Irrigation engineering, soil and water engineering or related field	Minimum 15 yrs working experience in related task including minimum 5 yrs on project coordinating or leading task

2	Senior Hydraulics Engineer	1	Bsc or above in hydraulic engineering, water resource engineering, Irrigation engineering, soil and water engineering or related field	Minimum 10 yrs working experience in related task
3	Senior Hydrologist	1	Bsc or above in hydraulic engineering, hydrology, water resource engineering, Irrigation engineering, soil and water engineering or related field	Minimum 10 yrs working experience in related task
4	Dam operation Expert	1	Bsc or above in hydraulic, civil engineering, water resource engineering, Irrigation engineering, soil and water engineering or related field	Minimum 8 yrs working experience in related task
5	Water Resource/Irrigation Engineer	1	Bsc or above in hydraulic engineering, hydrology, water resource engineering, Irrigation engineering, soil and water engineering or related field	Minimum 8 yrs working experience in related task
6	Structural Engineer	1	Bsc or above in hydraulic engineering, civil engineering, hydrology, water resource engineering, Irrigation engineering, soil and water engineering or related field	Minimum 8 yrs working experience in related task
7	Infrastructure Engineer	1	Bsc or above in hydraulic engineering, civil engineering, hydrology, water resource engineering, Irrigation engineering, soil and water engineering or related field	Minimum 8 yrs working experience in related task
8	Environmental safeguards specialist	1	Bsc or above in Environmental engineering, natural resource management or related field	Minimum 8 yrs working experience in related task
9	Social safeguard specialist	1	Bsc or above in social science, or related field	Minimum 8 yrs working experience in related task
10	Mechanical Engineer	1	Bsc or above in mechanical engineering or related field	Minimum 6 yrs working experience in related task
11	Geotechnical Engineer	1	Bsc or above in geology hydrogeology or related field	Minimum 6 yrs working experience in related task
12	Geologist	1	Bsc or above in geology hydrogeology or related field	Minimum 6 yrs working experience in related task
13	Surveyor	1	Bsc or above in surveying or related field	Minimum 5 yrs working experience in related task

14	Quantity surveyor	1	Bsc or above civil engineering, hydraulic engineering or related field	Minimum 8 yrs working experience in related task
15	GIS expert	1	Bsc or above in GIS, hydro-informatics, hydrology or related field	Minimum 8 yrs working experience in related task

- The experts must have proven experience in different and diverse projects (design and construction supervision, hydrological analysis, geotechnical study, geological investigation, hydrogeological study, etc.).
- The consultant must have proven track of record for successful implementation of study and design projects. Successful involvement of project in the river Basin with reference to flood risk management is a distinct advantage.
- The consultant must have rich experience in study, design and supervision of projects (flood protection, dam, diversion structure, irrigation, water supply, geological and geotechnical investigation, etc.) in the Basin.
- The consultant must possess the ability and commitment to execute the work with minimum supervision by the client.
- The consultant shall provide on job technical training and advice MoWE experts.
- The consultant must have rich experience in River Basin integrated water resource management modeling software
- The key experts must be a permanent staff (the consultant shall provide proof of evidence for availability during the project period with hiring contract agreement indicating basic salary);
- The experts must have proven experience in different and diverse projects (design and construction supervision, hydrological analysis, geotechnical study, geological investigation, hydrogeological study, etc.);
- The consultant must have proven track of record for successful implementation of study and design projects. Successful involvement of project in the river Basin with reference to flood risk management is a distinct advantage.
- The consultant must have rich experience in study, design and supervision of projects (flood protection, dam, diversion structure, irrigation, water supply, geological and geotechnical investigation, etc.) in the Basin.

- The consultant must possess the ability and commitment to execute the work with minimum supervision by the client.
- The consultant must be willing to provide on job technical training and advice MoWE experts.

10.Evaluation, Selection and Award

MoWE will evaluate all consultancy firms based on technical proposals submitted. The financial proposals will be evaluated for consultants whose technical proposal is accepted. Selection of consultant based on minimum financial proposal will not be considered.

11.Team Composition

The Consulting team should comprise a team of professionals with at least the following key personnel:

- ✓ **Key Expert 1: Senior Flood Management Expert (Team Leader**

Master‟s degree in Civil Engineering or Engineering Hydrology or equivalent Post Graduate Diploma closely related with scope of the work and from an accredited College or University an d
at least ten (10) years of professional working experience for international organization in flood risk management and mitigation (soft and Hard Measures). It would be an advantage if consultan t
has working experience in Floodwater Control or similar projects that includes hydraulic and hydrologic modeling, flood control planning and design of drainage structures.
Experience with HEC-1/HEC-HMS, HEC-2/HEC-RAS, open channel hydraulics, and hydraulic structures desired. Must also have working experience in engaging stakeholders in community ba se activities. A working knowledge of Arc-GIS software is a plus

The following skills are essential for this work:

- Academic specialization: Should have Bsc or above in flood risk management, hydraulic engineering, hydrology, water resource engineering, Irrigation engineering, soil and water engineering or related field from a recognized university
- Professional experience: Shall have Minimum 15 yrs working experience in related task on project coordinating or leading task
- Proven experience in managing large-scale flood risk reduction projects
- Strong project management and leadership skills
- Excellent communication and stakeholder management abilities

✓ **Key expert 2: Hydraulic Engineer**

Must have Bachelors or Master‟s degree in Bsc or above in hydraulic engineering, water resource engineering, Irrigation engineering, soil and water engineering or related field from a recognized university at least 10 yrs working experience in related task, Background in structural and hydraulic engineering, Experience in designing flood risk reduction infrastructure. His/her role is crucial in leading the feasibility study, detailed design, and tender document preparation for the Flood Risk Reduction Investment project in the designated river basin. His/her expertise in hydraulics engineering will be essential for developing effective and sustainable flood risk reduction measures. The following responsibilities and detailed task assignments are assigned to him/her:

✓ **Key expert 3: Senior Hydrologist**

Must have Bachelors or Masters degree in BSc or above in hydraulic engineering, hydrology, water resource engineering, irrigation engineering, soil and water engineering or related. He has to have Minimum 10 yrs working experience in related task. His/her expertise is integral to the success of the Flood Risk Reduction Investment project for the designated river basin. His/her responsibilities involve leading hydrological assessments, data analysis, and providing critical insights to support flood risk reduction measures. The following detailed task assignment outlines his/her responsibilities, Proven experience in leading hydrological assessments and modeling projects, rivers integrated water resource modeling, Strong analytical and problem-solving skills, Excellent communication and presentation abilities, Experience in climate change impact assessment is desirable, Experience in hydrological assessments, flood modeling, and risk analysis, Proficiency in relevant hydrological software

✓ **Key expert 4: Dam Operation Expert**

His/her role is crucial in contributing to the Flood Risk Reduction Investment project for the designated river basin. His/her expertise in dam operation and management will be instrumental in designing and implementing measures to mitigate flood risks. The following responsibilities and detailed task assignment outline his/her key tasks:

Qualifications:

- Academic specialization: Should have BSc or above in hydraulic, civil engineering, water resource engineering, irrigation engineering, soil and water engineering or related field from a recognized university
- Professional experience: Shall have Minimum 8 years working experience in related task
- Proven experience in dam operation and reservoir management
- Familiarity with dam operation modeling tools and software
- Strong analytical and problem-solving skills
- Excellent communication and stakeholder engagement abilities

✓ **Key expert 5: Water Resource/Irrigation Engineer**

His/her role is critical in contributing to the success of the Flood Risk Reduction Investment project for the designated river basin. His/her expertise in water resources and irrigation engineering will be instrumental in developing and implementing measures to mitigate flood risks. The following responsibilities and detailed task assignment outline his/her key tasks:

Qualifications:

- Academic specialization: Should have BSc or above in hydraulic engineering, hydrology, water resource engineering, irrigation engineering, soil and water engineering or related field from a recognized university
- Professional experience: Shall have Minimum 8 years working experience in related task
- Proven experience in water resource management and irrigation system optimization
- Familiarity with hydraulic structure design and modeling tools
- Strong analytical and problem-solving skills
- Excellent communication and stakeholder engagement abilities

✓ **Key expert 6: Structural Engineer**

His/her role is pivotal in contributing to the success of the Flood Risk Reduction Investment project for the designated river basin. His/her expertise in structural engineering will be instrumental in designing and implementing resilient structures to mitigate flood risks. The following responsibilities and detailed task assignment outline his/her key tasks:

Qualifications:

- Academic specialization: Should have BSc or above in hydraulic engineering, civil engineering, hydrology, water resource engineering, Irrigation engineering, soil and water engineering or related field from a recognized university
- Professional experience: Shall have Minimum 8 years working experience in related task
- Proven experience in structural design and construction oversight for flood risk reduction projects
- Familiarity with geotechnical analysis and seismic design (if applicable)
- Strong analytical and problem-solving skills
- Excellent communication and stakeholder engagement abilities
- Collaborate with the emergency response team to develop plans for rapid structural response during extreme weather events
- Conduct drills and simulations to test the effectiveness of emergency response procedures
- Prepare detailed reports on structural designs, geotechnical findings, construction oversight, and environmental considerations
- Ensure that documentation adheres to industry standards and project requirements

✓ **Key expert 7 Infrastructure Engineer**

His/her role is essential in contributing to the success of the Flood Risk Reduction Investment project for the designated river basin. His/her expertise in infrastructure planning and implementation will be instrumental in developing and implementing resilient infrastructure to mitigate flood risks. The following responsibilities and detailed task assignment outline his/her key tasks:

Qualifications:

- Academic specialization: Should have BSc or above in hydraulic engineering, civil engineering, hydrology, water resource engineering, Irrigation engineering, soil and water engineering or related field from a recognized university
- Professional experience: Shall have Minimum 8 years working experience in related task
- Proven experience in infrastructure planning and implementation for flood risk reduction projects
- Familiarity with urban planning and sustainable drainage practices
- Strong analytical and problem-solving skills
- Excellent communication and stakeholder engagement abilities

✓ **Environmental Safeguards Specialist**

His/her role is vital in ensuring that all project activities adhere to environmental standards, minimizing negative impacts, and promoting sustainability within the designated river basin. The following responsibilities and detailed task assignment outline his/her key tasks:

Qualifications:

- Academic specialization: Should have BSc or above in Environmental engineering, natural resource management or related field from a recognized university
- Professional experience: Shall have Minimum 8 years working experience in related task
- Proven experience in conducting EIAs and implementing environmental safeguards for infrastructure projects
- Familiarity with national and international environmental regulations
- Strong analytical and problem-solving skills
- Excellent communication and stakeholder engagement abilities

✓ **Social Safeguard Specialist**

His/her role is crucial in ensuring that the Flood Risk Reduction Investment project prioritizes social well-being and inclusivity. You will be responsible for addressing potential social risks and ensuring that project activities align with community needs and expectations. The following responsibilities and detailed task assignment outline his/her key tasks:

Qualifications:

- Academic specialization: Should have BSc or above in social science, or related field from a recognized university
- Professional experience: Shall have Minimum 8 years working experience in related task
- Proven experience in social impact assessments, community engagement, and resettlement planning
- Familiarity with gender equality and social inclusion principles
- Strong analytical and problem-solving skills
- Excellent communication and stakeholder engagement abilities

✓ **Mechanical Engineer**

His/her role is essential in contributing to the success of the Flood Risk Reduction Investment project for the designated river basin. His/her expertise in mechanical engineering will be instrumental in designing and implementing mechanical systems that contribute to flood risk reduction. The following responsibilities and detailed task assignment outline his/her key tasks:

Qualifications:

- Academic specialization: Should have BSc or above in mechanical engineering or related field from a recognized university
- Professional experience: Shall have Minimum 6 years working experience in related task
- Proven experience in the design and optimization of mechanical systems for water management projects
- Familiarity with hydraulic machinery and equipment
- Strong analytical and problem-solving skills
- Excellent communication and collaboration abilities

✓ **Geotechnical Engineer**

His/her role is pivotal in ensuring the stability and integrity of structures within the Flood Risk Reduction Investment project for the designated river basin. His/her expertise in geotechnical engineering will be instrumental in assessing soil conditions, providing foundation recommendations, and contributing to the overall success of the project. The following responsibilities and detailed task assignment outline his/her key tasks:

Qualifications:

- Academic specialization: Should have BSc or above in geology hydrogeology or related field from a recognized university
- Professional experience: Shall have Minimum 6 years working experience in related task
- Proven experience in geotechnical site investigations, foundation design, and slope stability analysis
- Familiarity with seismic design considerations

- Strong analytical and problem-solving skills
- Excellent communication and collaboration abilities

✓ **Geologist**

His/her role is integral to understanding the geological conditions within the Flood Risk Reduction Investment project for the designated river basin. His/her expertise in geological assessments and mapping will play a crucial role in informing project decisions related to infrastructure design and risk mitigation. The following responsibilities and detailed task assignment outline his/her key tasks:

Qualifications

- Academic specialization: Should have BSc or above in geology hydrogeology or related field from a recognized university
- Professional experience: Shall have Minimum 6 years working experience in related task
- Proven experience in geological assessments, mapping, and risk evaluations for infrastructure projects
- Familiarity with landslide risk assessment and groundwater studies
- Strong analytical and problem-solving skills
- Excellent communication and collaboration abilities

✓ **Surveyor**

His/her role is crucial in providing accurate and reliable spatial data for the Flood Risk Reduction Investment project within the designated river basin. His/her expertise in surveying will contribute to precise measurements, mapping, and topographical information essential for project planning and execution. The following responsibilities and detailed task assignment outline his/her key tasks:

Qualifications:

- Academic specialization: BSc or above in surveying or related field from a recognized university
- Professional experience: Shall have Minimum 5 years working experience in related task
- Familiarity with geodetic control establishment and hydrographic surveys
- Strong analytical and problem-solving skills
- Excellent communication and collaboration abilities

✓ **Quantity Surveyor**

His/her role is pivotal in managing the project's cost and ensuring effective financial control throughout the Flood Risk Reduction Investment project within the designated river basin. His/her expertise in quantity surveying will contribute to accurate cost estimations, budget

management, and financial reporting. The following responsibilities and detailed task assignment outline his/her key tasks:

Qualifications:

- Academic specialization: BSc or above in civil engineering, Quantity Surveying, hydraulic engineering or related field from a recognized university
- Professional experience: Shall have Minimum 8 years working experience in related task
- Proven experience in quantity surveying for large infrastructure projects
- Familiarity with cost estimation software and project management tools
- Strong analytical and problem-solving skills
- Excellent communication and collaboration abilities

✓ **GIS Expert**

His/her role is pivotal in providing geospatial insights and support for the Flood Risk Reduction Investment project within the designated river basin. His/her expertise in Geographic Information System (GIS) will be crucial for data analysis, mapping, and decision-making processes. The following responsibilities and detailed task assignment outline his/her key tasks:

Qualifications:

- Academic specialization: BSc or above in GIS, hydro-informatics, hydrology or related field from a recognized university
- Professional experience: Shall have Minimum 8 years working experience in related task
- Proven experience in GIS analysis and mapping for large-scale infrastructure projects
- Proficiency in GIS software (e.g., ArcGIS, QGIS) and data visualization tools
- Strong analytical and problem-solving skills
- Excellent communication and collaboration abilities