Terms of Reference

For Feasibility Study, Detail Design and Tender Document Preparation of Upper, Middle and Lower Awash River Flood Risk Reduction Investment

March 2023

Addis Ababa

Ethiopia

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. Two of the more advanced projects, in terms of project preparation, include the Upper Awash Integrated Flood Management Project and the Middle and Lower Awash Flood Control and Protection Project. These two river-based projects will protect areas across several Woredas, in involves the construction of river dykes as a primary flood risk reduction element.

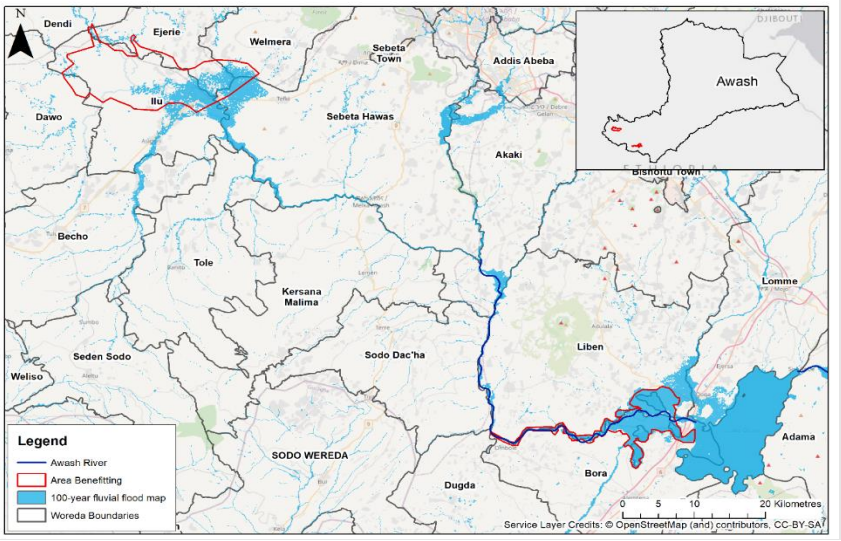

Figure 1.Areas benefitting (red polygons)

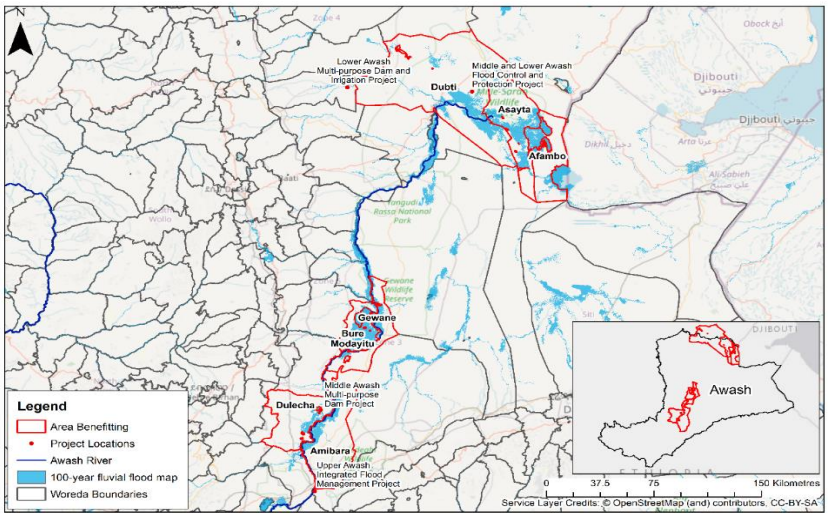

Figure 2: Areas benefitting

(red polygons) from the two proposed river projects: Upper Awash Integrated Flood Management Project (top) and the Middle and Lower Awash Flood Control and Protection Project (bottom).A technical review of the hydrological and hydraulic analysis underpinning these projects highlighted several aspects that would requirement further consideration before a detailed design of flood risk reduction and associated infrastructure can be finalized, including:

1. Additional data collection - Site-specific data collection, including terrain data, appears not be sufficiently detailed (based on the reports made available). Additional field surveys and observations may be needed to strengthen the data basis for further detailed studies.
2. Additional feasibility design exploration - At this point the design details can be described as at the level of pre-feasibility. As such, the design of the flood risk reduction infrastructures is conceptual, consisting of a generalised dike alignment within the priority areas. There may be opportunities to optimise of selection of flood risk reduction options including attenuation schemes, and the route and alignment of the dike (where selected) and ensure the design concept takes account of best practice principles that can then be carried forward to detailed design stages.
3. Additional supporting hydrological and hydraulic analysis – The existing hydrological analysis is deemed reasonable for a pre-feasibility. But further 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 more robust feasibility stage assessment. If necessary, associated hydraulic modelling to determine the areas benefiting from the scheme and the standard of protection afforded.
4. Consolidated and auditable reporting trail - Reporting did not provide a conclusive audit trail of some key aspects of the analysis, including:
   - the treatment of observational data used as inputs, including gap filling techniques
   - justification of model parameters, including more robust and rigorous calibration and sensitivity testing
   - a lack of direct 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.
5. Inclusion of climate and other future changes into the project feasibility design process - There is no evidence to the consideration of climate change being part of the feasibility studies and the design of hydraulic structures assumes stationarity. Risk assessment to determine the likelihood and impacts of drainage exceedance has not been analysed.

Therefore, while a significant volume of project preparation work has been undertaken, 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. An audit of the work done to date is required as well as further detailed conceptual design studies to optimize the overall design including the dyke alignment and costings of capital costs and civil works.

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 document preparation of Awash River Flood Protection and Control Project. The geographic domain of the works lies on Awash River main course starting from upstream starting point of the river up to the end of the river and near the confluence point of the major tributaries in the specified reach length. The scope of work shall focus on a refined hydrological and hydraulic analysis that informs a sound scheme design, while advancing the existing feasibility concepts to a greater level of detail and optimization, the flood risk elements of the river projects, which may then be used to inform other aspects and possible benefits of the project including irrigation, wetland preservation and regeneration and opportunities for wider strengthening of catchment management. Then, the engineering design of the physical hydraulic infrastructure that reduce flood risk so that the economic damage and life hazard shall be controlled while the socio-economic and environmental benefits of the water resource being realize. 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 MoWE/BDO utilizes 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.

3.Introduction

The Awash River basin is the most intensively developed river basin in Ethiopia. The highest economic value and assets of the country is predominantly located in this basin. These assets can range from the major cities like Addis Ababa, Dire Dawa and Adamato the majority of irrigation scheme and their industries located in the upper, middle and lower valleys. The majority of irrigated horticultural farm including the cane farm of the Ethiopian Sugar Corporation is located in the flood prone areas of the middle and lower valley. Not only that the lion share of large scale

irrigation scheme in the country is located in this basin, but also the fruit farms and cane farms are mainly found in this important basin. Life and assets in the middle and lower valley of Awash basin is subjected to frequently damage by flooding which is getting aggravated from year after year due to increase in pressure on the river course, change in river morphology and regional climate change.The occurrence of the flood due to bank overflow/overtopping in many Weredas in west Shoa Zone of Oromia Region specifically in SebetaHawas, Wolmera and Egeria Weredas in September, 2017 G.C; Liben-Chuquala and Bora Weredas in the years 2014,2016,2017; at Fentale in 2012,2015,2017Afambo in 1993; in Dubti in 1994; in Assaita in 1995; in Bure-Mudaitu and Gewanie in 1993, 1994,1995 and 1996; in Dulecha and Amibara in 1996; dyke breaching at Amibara area in 2014;and overflow/overtopping from Gefremto Debel in 2015 and in 2020 can indicate the seriousness of the flood problem.

According to the Ethiopia Disaster Risk Management Commission (EDRMC), the 2020 floods were one of the most severe in decades, with 288 fatalities, over one million people affected and an estimated 292,000 people displaced .Rapid geodata informed assessment by the World Bank found that the floods impacted an estimated 38,600 buildings, 1,350 km of the road network, and 164,000 ha of cropland. Direct flood damage to just these assets was estimated at US$ 358 million.

As a result hundreds of thousands of people life is affected and millions of birr economic damage cost has attributed due to flooding. Emergency flood protection and community evacuation work by the Ministry of Water and Energy become a regular and routine job. The Ministry of Water and Energy is seeking for sustainable solution that improve the river channel systems and network by strengthening of the infrastructure to control flood while maintaining reliable water supplies to the irrigation scheme throughout the year. Therefore, the Ministry of Water and Energy currently reached in milestone stage to mark the flood protection and control of Awash River as the most priority project both in terms of safeguarding the economic value as well as increasing wellbeing of the community living in the basin.

The scope of service stipulated in this term of reference is, however, prepared solely for flood risk reduction for selected target areas identified and prioritized through this consultancy in reference to existing studies already conducted.

4.Rationale of the Project

The rationale of the project is to stimulate sustainable socio-economic development and enhanced safety against flood hazard due to Awash River.

The principal objective of the intended scope of work is to carry out the feasibility study and detail design of Awash River flood risk reduction and associated infrastructures in order to safeguard the assets and life of the community and business sector that depends on Awash river.

5.Scope of Work

The consulting firm shall carry out the Feasibility Study and Detailed Design of the Flood Risk Reduction and Associated Infrastructure with nationally and internationally known and Bank accepted standards.

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) A high level screening and assessment of available data and refinement of approach: all the main analytical and modeling 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 government of Ethiopia 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.
d) Preparation of a detailed methodology and program for all of following tasks
e) Development of a refined integration and training plan including secondment, workshop and training components, to be implemented through the project in order for the government of Ethiopia (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 audit, analysis and survey

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

a) Evaluate and test the validity of input data utilized and assess need for data collection and field surveys, with regard to observational data sets
b) 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 optimization studies
c) 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
d) Evaluate any areas of data analysis that need to be revisited, and carry out the necessary reanalysis
e) Develop draft scope for technical implementation of required field surveys,
f) Conduct agreed additional surveys,
g) 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 ABDO. This is expected to be accomplished through a mix of secondments, on-the-job training and workshops. As noted earlier, the consultant is expected to refine their proposed training and integration plan through the inception phase.

Task 2 deliverables: required outputs include (1) technical scope for required field surveys, (2) results of 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/ABDO 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 the 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 hydrochronology 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) PMP analysis: Hershfield 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-dimentional 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 will be referred appropriately; and
m) Write a report that documents methods, calculations and decisions made. The work needs to be documented in a manner that is auditable.

The updated 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 reworked 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 in the vicinity of 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 the environmental and social impacts (including resettlement area and number of population to be relocated). 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 possible (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 (currently dyke alignment is shown as continuous throughout the project area – this may not be necessary).

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.

Sustainable materials: consider the opportunity to use sustainable material and construction methods that can be sources locally. 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 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 3 options with clear concept, multi criteria comparison, and rationale for recommended option(2) 2 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 benefitting 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 2 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 consultants own observations from its own review of previous work. This approach must account for the catchment characteristics and 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 foreseeable 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).

Task 5 deliverables: (1) adraft 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

The World Bank recently concluded a consultancy to develop a strategic investment framework for flood risk management in Ethiopia. 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 (Figure 32) 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 two Awash Basin river 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.

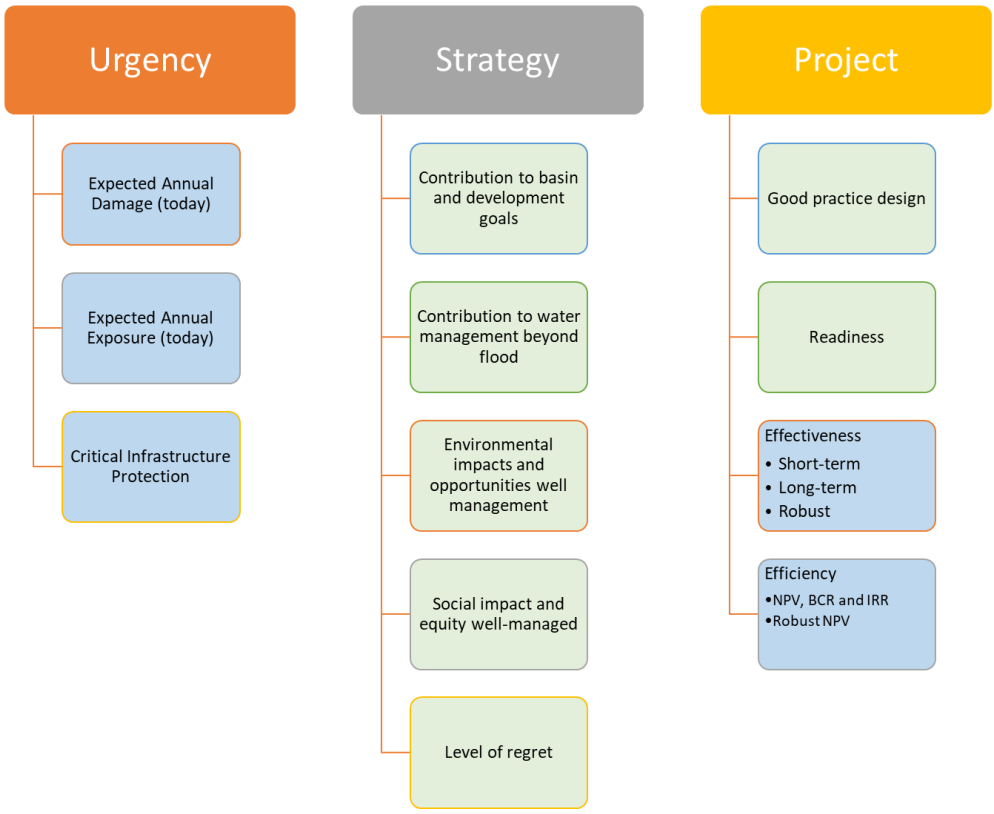

Figure 3: Overview of the strategic flood risk reduction investment framework recently developed for the GoE

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 river protection works proposed given the scale and complexity of the assignment. First, unpriced technical proposals on the basis of a conceptual design or performance specifications are invited, subject to technical as well as commercial clarifications and 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 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:

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

1 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 Government of Ethiopia 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 number of trainees will be 70 and the consultant will cover the cost of venue and participants.

6. Duration of Contra and deliverables

As per 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		Deliverables to be submitted to MOWE	Due		Remarks
1	Kick off meeting		-	Within 1 week from signing of the contract		To ensure proper inception
1	Inception Report	✓ Shall include thorough review of existing studies, including Upper, Middle & Lower Awash, 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		
2	Data audit, analysis and survey		See detail under task 2	2.5 months from signing		
3	Update of hydrological and hydraulic analysis and setting target flood events and sites		See detail under task 3	4 months from signing		
4	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		
5	Hydraulic modeling and hazard mapping		See detail under task 5	8 months	Can be done in parallel	

6	Application of Flood Risk Reduction Investment Framework		See detail under task 6	9 months		
7	Detailed Design and Tender Documents		See detail under task 7	10 months		
8	Training and Capacity building	✓ This task should be conducted throughout the consultancy, in align with each deliverables. ✓ Plan for training and capacity building should be approved at the inception stage, and several milestones should be identified by the consultant. ✓ 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 Ministry of Water and Energy 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 Awash basin social, economic and environmental context;
- Prepare detail and comprehensive technical proposal indicating overview of the basin situation assessment with regards to 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 sub task teams for Upper Awash, Middle Awash, and Lower Awash, respectively 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 consultant key expert requirement

s. no	Required Key experts	Required Number	Qualification	Relevant experience
1	Lead flood risk management Expert (Team Leader)	3	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	Minimum 8 yrs working experience in related task

			engineering, soil and water engineering or related field	
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,hydroinformatics,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 Ministry of Water and Energy experts;