Ministry of Water Resources and Meteorology
(MOWRAM)
Climate Adaptive Irrigation and Sustainable Agriculture for Resilience Project
(CAISAR)

Terms of Reference for Detailed Engineering Design Phase 2 (DED2) for four (4) Irrigation Schemes in four provinces: (i) Ou Ta Poung in Pursat,, (ii) Yutasas in Kampong Chhang, (iii) Stung Kraing Bat in Kandal & (iv) Brambei Mom in Kampong Speu

A. Background

The Royal Government of Cambodia (RGC) has requested the Asian Infrastructure Investment Bank (AIIB) for assistance to finance the loan financed " "Climate Adaptive Irrigation and Sustainable Agriculture for Resilience" (CAISAR) Project (the loan project). As a result, the AIIB approved a PPSF grant in February 2021 to assist the RGC through MOWRAM in preparation of the project design documents. The loan project is expected to be financed by Asian Infrastructure Investment Bank (AIIB) with co-financing from the International Fund for Agricultural Development (IFAD) and potentially the Green Climate Fund (GCF). The total project cost is estimated to be USD240 million.

The CAISAR loan project objective is to increase climate adaptation, mitigate the negative impact of extreme climate events, and improve the livelihoods of smallholder farmers and vulnerable rural communities in four provinces of Cambodia. The loan project will have three components: component 1-farm-level climate adaptation and resilience; component 2-upgrading and climate-proofing water infrastructure for increased resilience; and component 3-strengthened institutional and regulatory capacity for low-emission climate-resilient development pathways.

The project is divided into three sub-project areas (Ou Ta Poung, Lum Harch and Krang Ponley) with 6 irrigation systems potentially totaling 32,056ha of cultivated land for which 22,051ha would be provided with upgraded or new irrigation or drainage facilities. The CAISAR project is expected to improve water availability year-round and provide better drought resilience over the 25–30-year asset life, allowing farmers to do more crops (up to three crops) per year with significant agricultural yields and crop production improvements in all the three sub-project areas.

The schemes will have both on-farm and agricultural system improvements (Component 1), as well as main irrigation and drainage system-related works (Component 2). The focus for MOWRAM will be on upgrading technical capacity in various aspects of climate resilient irrigation design and management of the main systems under component 2.

B. Project Components

Component 1. Improving Farm-Level Climate Adaptation, Resilience, and Water Use Efficiency

The project will target rural beneficiaries living in the command areas and at the upstream level. Key activities under Component 1 will include:

(i) Deployment of farm-level climate adaptation and water use efficiency measures (incl. farm gate tracks)
(ii) Rural road connectivity improvement
(iii) Climate-adapted, value-added, and market-led livelihood development.
(iv) Improve enabling conditions, capacities, and disaster risk management strategies and implementation capacities.
(v) Capacity building, M&E, and Policy Support for the implementation of greenhouse gas emissions reduction and climate change adaptation .

Component 2. Climate-Proofing Water Infrastructure for Increased Resilience

The project system will provide adaptation and resilience to the changing climate, resulting in cleaner and more consistent water flows for double or triple cropping, higher value crops, efficient supply/equipment to plant/harvest, farm-level access with farm roads, and better access and speed to markets, which will result in higher value added and lower production costs. Key project outcomes will include increased climate adaptability of farmers, increased farm incomes in some of the key climate-smart demonstration areas, Green House Gas (GHG) emissions reduction of up to 70% from rice and non-rice crop production, and smallholder release from flood distress.

The component will provide climate-friendly and climate-proofed canals to manage the water supply in response to climate change. The scheme will apply nature-based solutions, such as using natural materials for canals, canal stability (adjacent vegetation), compaction to prevent erosion, entry points for Operations &Maintenance (O&M), and better drainage (more chance to increase crops and achieve better water quality). The key activities of Component 2 will include:

(i) Rehabilitation and construction of a complete irrigation scheme (including tertiary canals able to supply water by gravity or by solar pumping to lined or piped tertiary systems, on-farm storage ponds, and canals along access roads);
(ii) Flood proofing and drainage improvement;
(iii) Innovative Approaches and digitalization, SCADA, and asset management
(iv) Water Management (O&M, FWUC/FWUA, and FWUG formation and capacity development,)
(v) Dam Safety Improvement

The project is integrated with other national initiatives in the water sector under MOWRAM responsibilities, including development of the National Water Resource Information System (WRIS) and National Water Resource Management Data Centre (NWRMDC) that include improvement of the hydrometeorological data collection, storage, and availability. This also includes development

of monitoring water use/water accounting, flood forecasting, additional radar rainfall stations and processing, agricultural market information systems, asset management and information dissemination to all concerned parties including farmer groups. Where such aspects are already being implemented, they are not duplicated by CAISAR.

C. Project Location

This TOR details the scope of work for Component 2 activities for two irrigation systems. It concerns the detailed engineering design for improvement of the Ou Ta Poung located in Pursat province, and the smaller schemes Yutasas, Brambei Mom and Stung Krang Bat located in Kampong Chhnang, Kampong Speu and Kandal provinces, that are concerned with water management and infrastructure development. The works should consider the inputs from component 1 as both components (1&2) are inter-related and need to work together.

Ou Ta Poung Irrigation System, for the DED, covering a command area of 14,874ha is located in the western part of Pursat Province, on the National Road No. 4, along the border with Battambang Province, see Figure 1 and 2. The scheme receives water mainly from Ou Ta Poung River that further distributes water to the command areas through secondary and tertiary canals. In addition, it is proposed that in order to fully supply the command area at the scheme, a combined option of taking water from Damnak Ampil and Kbal Hong water sources that require additional social and technical works.

Yutasas irrigation system covering a command area of 593ha is located in Kampong Chhnang province sitting next to the other sub-schemes, including Krapeu Trom and Stung Krang Bat shown in Figure 3. The scheme receives water from Anlong Chrey reservoir in the Krang Ponley river. The Yutasas system is one in a series of irrigation systems taking water from the Krang Ponley river downstream of the Anlong Chrey Reservoir.

Stung Krang Bat irrigation system covering a command area of 994 ha is located n in Kandal province. The command area is at the very tail end of Krang Ponley river downstream of Yutasas system and is partially located in the active floodplain of Tonle Sap river (Fig 5). The canal system needs rehabilitation and improvements to the drainage arrangement.

Brambei Mom irrigation system covering a command area of 1,000ha is located in Kampong Speu province on the banks of river Ou Khley, it has its own rather minor reservoir, but this can receive supplementary supply from an outlet on Anlong Chrey Reservoir (Fig 4). The irrigation scheme infrastructure was not fully completed, resulting in canals that are too short and an insufficient number of structures, which are now in poor condition. The scheme requires rehabilitation of existing canals and new construction of additional canals and structures.

A separate study has been conducted for Krapeu Trom but the water requirements for this scheme should be considered in the detailed planning of the downstream schemes Yutasas and Stung Krang Bat.

Figure 1. Map of Irrigation Project Location

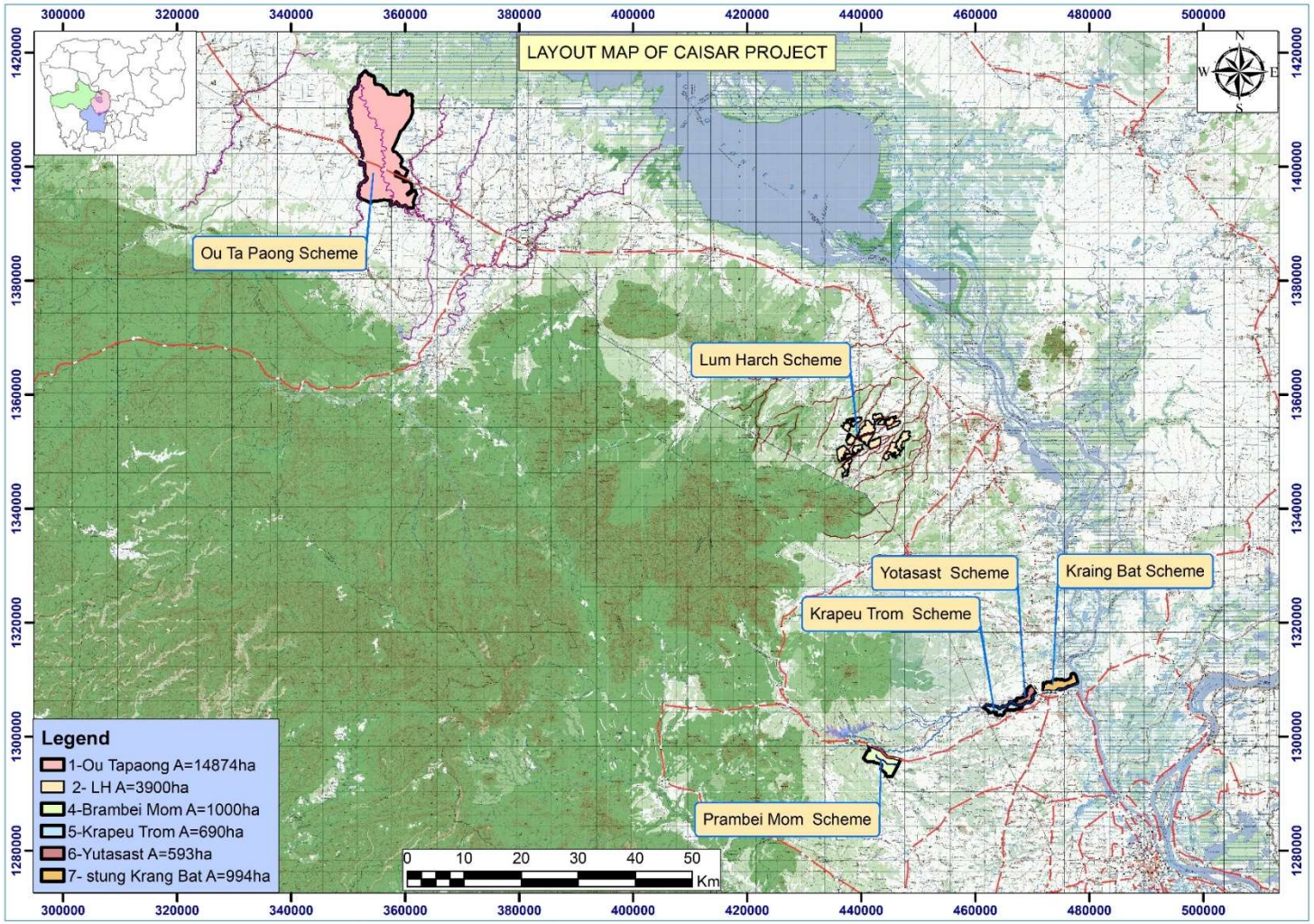


Figure 2. Layout Map for Ou Ta Poung Irrigation System, in Pursat Province

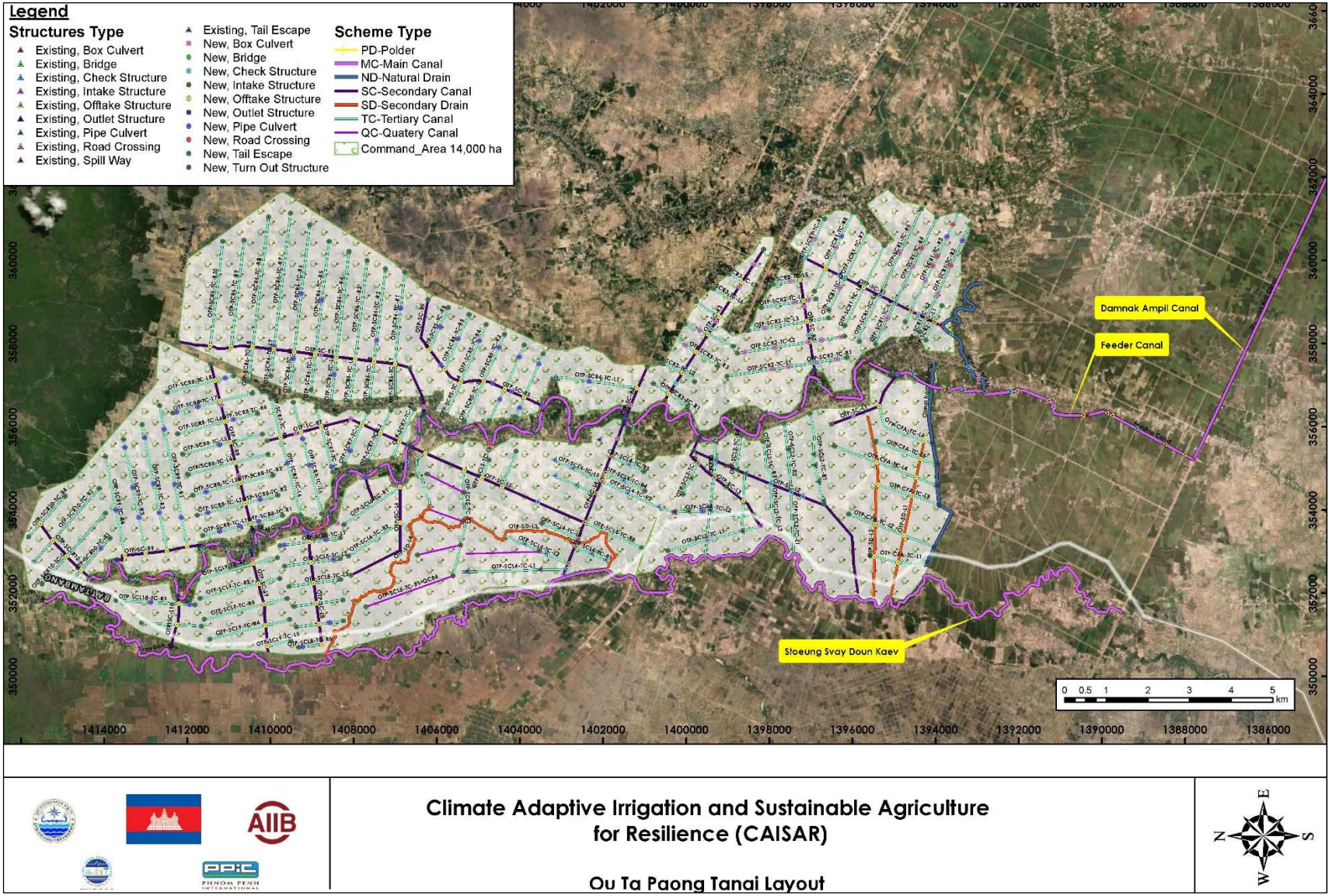


Figure 3. Layout Map of Krang Ponley Irrigation Schemes

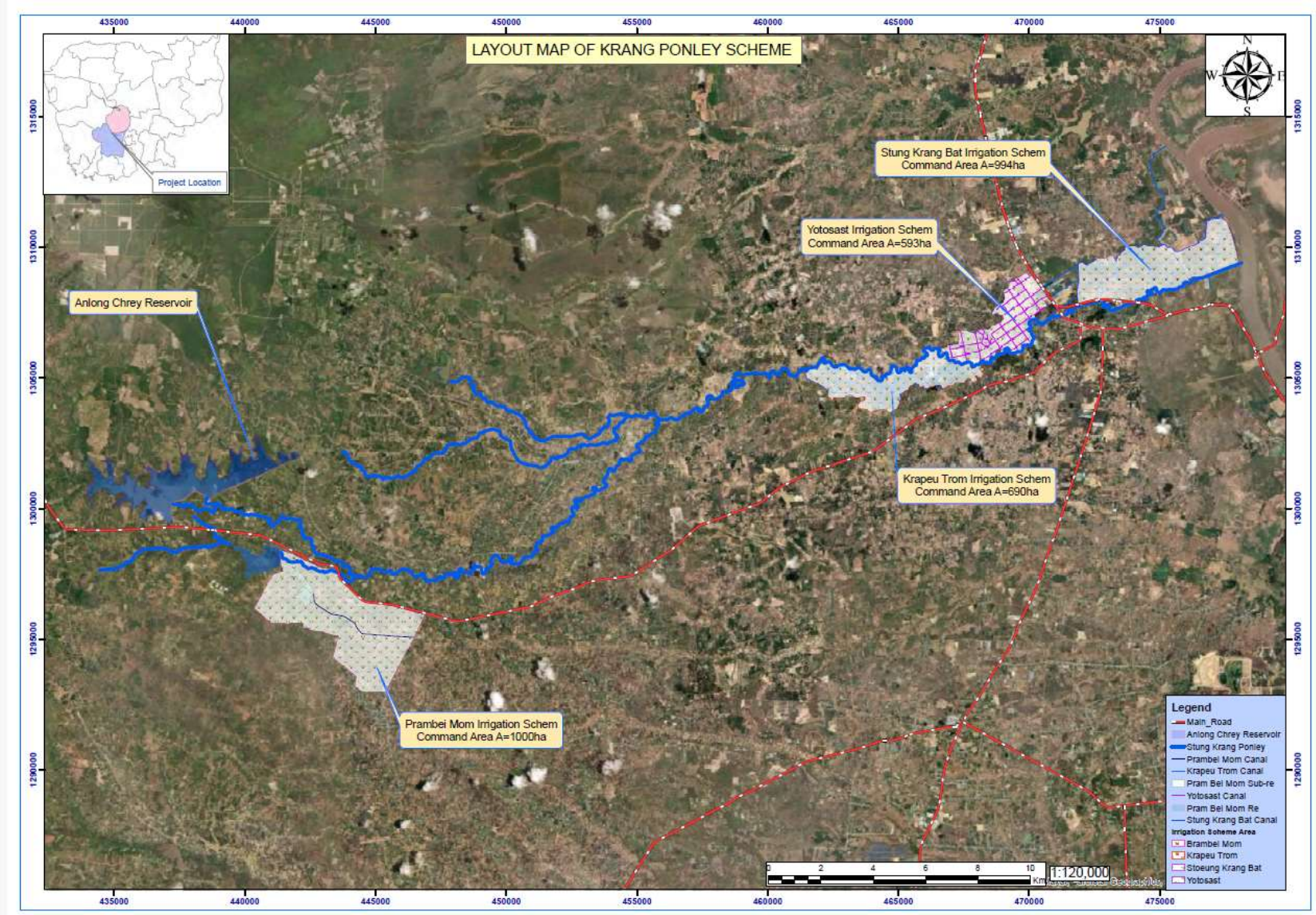


Figure 4. Layout Map of Brambei Mom Irrigation Scheme

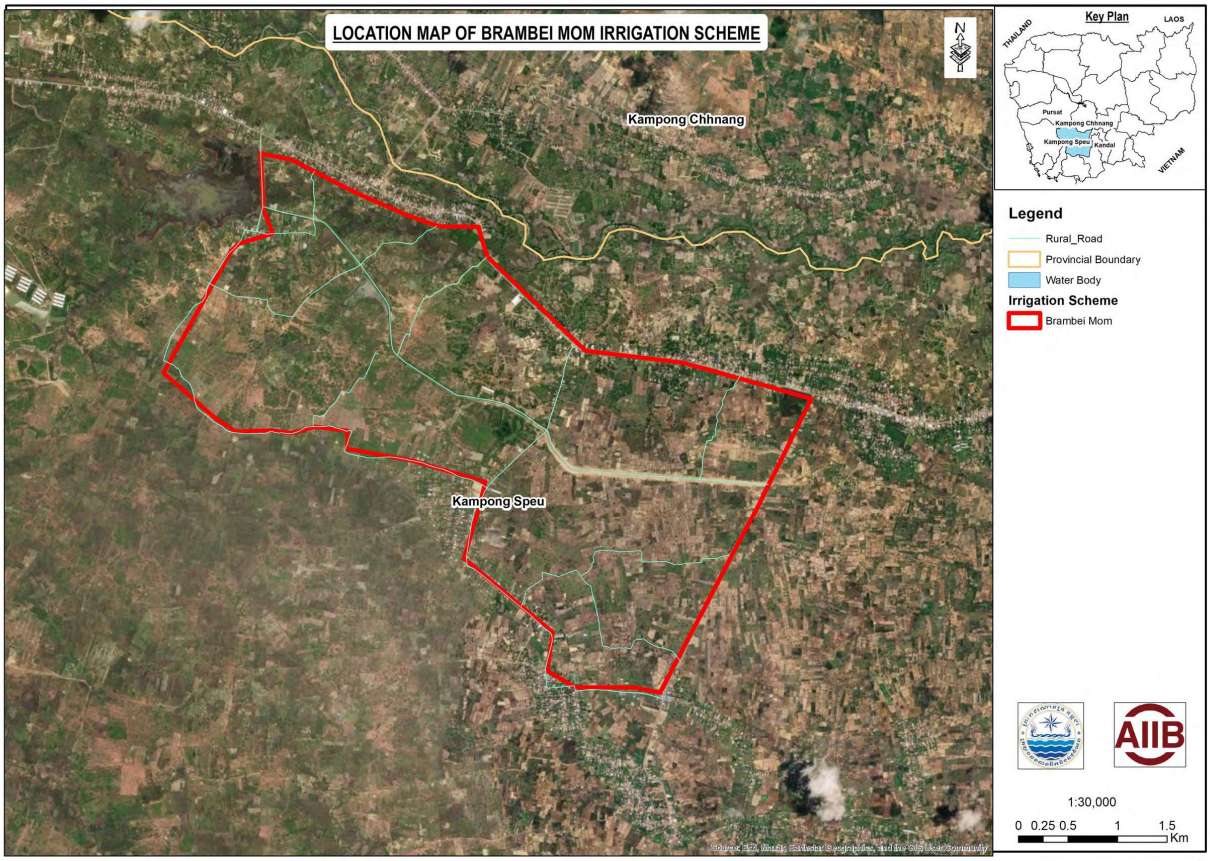
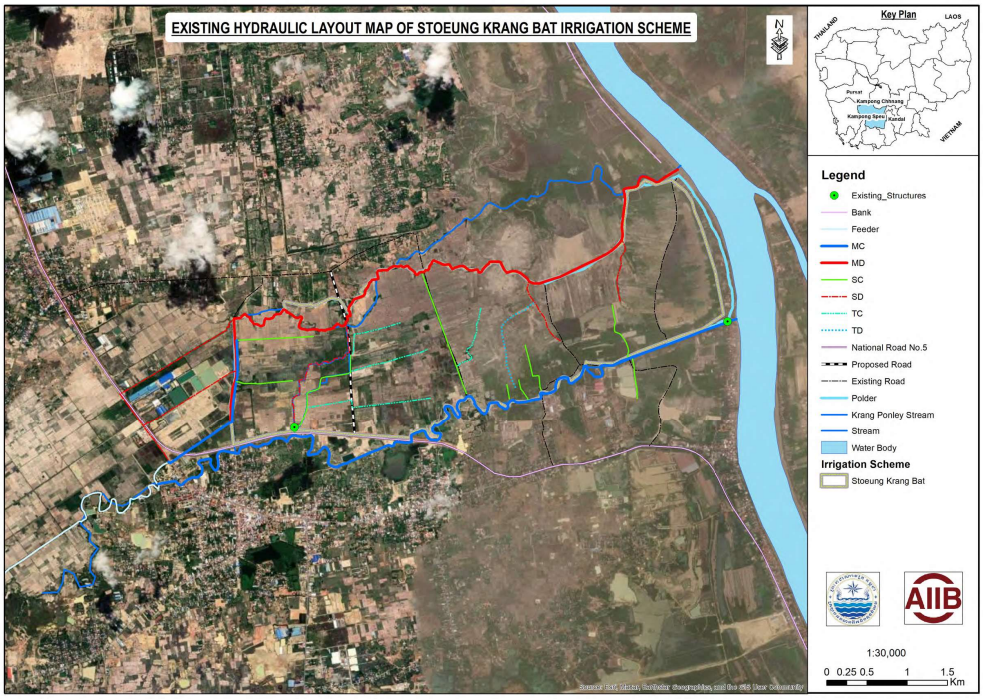


Figure 5. Layout Map of Stung Krang Bat Irrigation Scheme



D. Objective

MOWRAM is currently looking for a qualified and experienced consulting firm to conduct (i). Detailed Engineering Design Phase 2 (DED2) of the Advanced Action works for the selected irrigation and drainage infrastructures for Ou Ta Poung (Pursat province), Yutasas, Stung Krang Bat and Brambei Mom. In addition, the selected consultant team will also be required to conduct review of the existing project documents, especially the Feasibility Study Reports (FSR) of the identified schemes, and provide as a basis for the DED2 feasible options for the development of the irrigation and drainage infrastructure with strong consideration of climate resilience, flood proofing and sustainable agriculture. The selected consultant firm will be working closely with the MOWRAM Project Management Unit. The specific scope of consultant services is provided in the next section of this TOR.

E. Scope of work

The scope of the services includes but not to be limited to the following tasks:

1) Detailed system inventory and assessment of options

a) **Review** Feasibility studies, supporting documents and available surveys concerning the four irrigation schemes with particular emphasis on water availability for the Ou Ta Poung, Yutasas, Brambei Mom and Stung Krang Bat systems in the context of the other irrigation systems also obtaining water from the relevant water sources, including rivers, dams and reservoirs. Prepare associated hydrology report with verification of water availability and occurrence of inundations due to rainfall and river floods.

b) **Water Management Plan**. Prepare an assessment of the current water management arrangement and detailed water management plan with options for improvement considering the upstream and downstream irrigation systems in consultation with the local communities, farmer water user committees and the PDWRAM

c) **Irrigation and Drainage System Plan**. Prepare in a participatory manner

   i. a detailed assessment of the current condition of the irrigation and drainage infrastructure and

   ii. formulate a system plan based on agreed water management plan with needs and options for improvement, in consultation with the local communities, farmers and Farmer Water User Committees (FWUC) and the PDWRAM concerned.

   iii. Propose various **design options** for the whole system as well as different individual canals, drains, and structures including engineering cost estimates and the economic internal rate of return (EIRR) for the system.

   iv. Prepare **system layouts** of different components of the systems such as water supply channel or feeder canals, main canals, and irrigation distribution

networks with control structures, drainage networks, flood diversion channels, flood control structures, polders, levees, and associated facilities.

d) **Additional Surveys**. Identification and specification of necessary supplementary surveys and investigations, including preparation of cost estimates and terms of reference.

2) **Detailed Engineering Design (DED) for** Ou Ta Poung, Yutasas, Stung Krang Bat and Brambei Mom **Irrigation Schemes**

a) Prepare **design criteria** for hydraulic and structural design of irrigation and drainage canals, conveyance and flow control structures. The conceptual design incorporating design criteria and design approach with relevant standards should be submitted with the inception report and only after approval detailed designs should be prepared.

b) Perform **hydraulic design** based on agreed system plan for all irrigation canals, drains, and all associated hydraulic structures including but not limited to head regulators, check structures, inlets, outlet structures, flood diversion structures, sluice gates, etc. The hydraulic design has to include an assessment of the possible impact on the conditions and impacts of the hydraulic behaviour of the water distribution systems, including Damnak Ampil and Kbal Hong rivers in Pursat province and Krang Ponley river in Kampong Chhnang province, and the water availability in terms of water quantity and water levels for the other irrigation systems in the Krang Ponley schemes considering CAISAR interventions proposed in the feasibility studies.

c) Perform **structural analysis and design** for structures required for the system. These structures include but are not limited to head regulators, sluice-gates structures, check regulators, outlet and inlet structures, cross drainages, crossing bridges, pedestrian bridges, canal lining, slope protection, retaining walls, safety measures, flood protection works etc. This task also includes stability assessment of the canals and drains slopes, stability of canal and road embankments as well as access surface structures (as existing). Design of additional structures as needed is included in the scope of work.

d) Produce **technical design drawings** (architectural design or formwork and detailed construction drawings) for all canals, drainages, and all structures covering all the identified systems. These drawings will be submitted in hard copy and in CAD files fully compatible with the CAD system format of MOWRAM and suitable for update into as-built-drawings after construction works.

e) Prepare **Bill of Quantities (BoQ)** and **Engineering Cost Estimate (ECE)** and breakdown for different construction packages for the four schemes, especially Ou Ta Paong scheme. The packaging process will require coordination and approval from the PMU.

f) Prepare bidding documents including t**echnical specifications** for the construction works for all related activities in each civil work construction activity. The technical specification will have to include safeguard documents such as 1). Environmental, Social and Climate

Management Plans (ESCMPs), 2) Biodiversity Action Plans, 3). Resettlement Plan, 4). Gender Action Plan. Some of these documents will be prepared with support from PMU.

g) Support the PMU with civil works **contracts bidding documents** preparation in a phased manner, including technical specifications and provide assistance during the procurement process.
h) Develop an **Operation and Maintenance Manual** in accordance with the agreed water management plan and guideline / template provided if any;
i) Provide DED2 related support to the PMU where needed.
j) Submit the draft report, including a detailed economic analysis scheme wise, for review by the government and other stakeholders (such as AIIB and other financing partners). Incorporate their comments and observations to produce a final, acceptable report. Provide the final report in both agreed-upon soft and hard copy formats.

F. Duration of Assignment

If everything is going seamlessly as expected, the Assignment is expected to be completed within a **9-month period**, tentatively starting from Aug 2025-Apr 2026.

G. Reporting Requirements and Deliverables

The deliverables and their time of delivery by the consultants are specified in table 1.

Table 1: Deliverables for the DED2 of Ou Ta Poung, Yutasas, Stung Kraing Bat and Brambei Mom *Irrigation Schemes*:

No.	Expected output/deliverable	Indicative Delivery Date (weeks since contract signing)	
		Draft	Final
D01	Inception Report with conceptual design, workplan, milestones and staffing schedules.	3	4
D02	Water Management Plans, including Cropping Calendar and Irrigation Scheduling	8	10
D03	Irrigation and Drainage System Plans along with flood management plan with costs	12	14
D04	Hydrological Design Reports	7	9
D05	Hydraulic Design Reports	14	16
D06	Structural Design Reports	16	18
D07	Detailed Technical Drawings	16	18
D08	Bill of Quantity and Engineering Cost Estimate	20	24
D09	Bidding document with technical Specification for the bidding including relevant documents—ESCMP, Health Safety, Genders	22	24
D10	Operation and Maintenance Manuals	32	34

D11	Final Report including economic analysis. after complying to the AIIB and Government Reviews	34	36

Note: i. The schedule of deliverables from D02-D09 is indicative only and it should be submitted scheme wise as part of inception report and agreed by MOWRAM.

ii. The deliverables from D02-D09 for the schemes (i) Ou Ta Poung (ii) Yutasas, (iii) Stung Kraing Bat& (iv) Brambei Mom should be submitted within 6 months of contract.

On top of the deliverables listed above, the selected consultant firm shall also submit a Monthly Progress Report, at the end of each month all below reports and outputs/ deliverables to the PMU/MOWRAM:

H. Contract Amount and Payment Schedule

The contract will be a lump-sum not exceeding a total amount of USD 1,101,000.

The payment schedule is based on the deliverables submitted and subject to approval from MOWRAM as below:

Table 2: Payment Schedule

Payment Number	Key Deliverables	% of Contract Price	
1	Mobilisation	10% of total contract amount	
2	Deliverable 01 Deliverable 02 Deliverable 03 Deliverable 04	20% of total contract amount	
3	Deliverable 05 Deliverable 06 Deliverable 07	30% of total contract amount	
4	Deliverable 08 Deliverable 09 Deliverable 10	30% of total contract amount	
5	Deliverable 11	10% of total contract amount	

Note: The consulting firm should submit the break-up of payment number 2-4 for each scheme for approval by MOWRAM and the payment to be regulated accordingly.

I. Consultant Qualifications and Staff Inputs

The following requirements are a broad description of the likely expertise needed for this consultancy assignment. The Consultant may propose additional experts in the Technical Proposal as may be needed to fulfil this TOR. The consultant may mobilise supporting experts and administrative staff as necessary to execute the Scope of Services. The Consultant is encouraged to engage a diverse team composition, including mixture of genders.

The Consultant is expected to:

(i) Be a firm with appropriate and sufficient capabilities, resources, and experience to execute the full extent of the Scope of Services with good quality.

(ii) Core business experience in water resources, irrigation, and flood management including engineering design services. Have demonstrated experience in water and irrigation sector development.

(iii) Have a proven record of completing at least one technical study and DED for each of the following assignments: i) large-scale and complex irrigation systems, ii) flood management, and iii) drainage systems, within the last 10 years (2014 – 2024). in Southeast Asia region with either government or private sector clients in the last 10 years (2014 – 2024).

(iv) Have the experience of working with Multilateral Development Banks (MDB) financed projects and at least one contract of similar nature and value in the last 10 years (2024 – 2024).

On top of the minimum requirements for the consultant inputs listed in Table 3. If needed for the detailed surveys, the firm shall mobilize a qualified topographical and geotechnical survey team and adequate survey equipment to perform whatever additional detailed topographical survey is required for completing the design of the infrastructure. The cost for topographical survey work is included into the overall contract cost as a provisional sum for which approval will be needed by MOWRAM. Further, survey for the detailed resettlement plan and Inventory of Loss will be procured through the PMU under a separate budget.

Table 3. Suggested Team Composition

		Input (person-month)	
No	Position	International	National
	Key Experts		
1	Team Leader / Irrigation and Water Resources Management Specialist	9	
2	Irrigation Design Specialist / Deputy Team Leader		9

3	Irrigation & hydraulic design Specialist	9	
4	Irrigation & hydraulic design Specialist		9
5	Flood and drainage expert	4	
6	Flood and drainage expert		4
7	Structural Design Engineer	4	
8	Structural Design Engineer		4
9	Resettlement Specialist	3	
10	Resettlement Specialist		3
11	Agriculture Specialist	2	
12	Agriculture Specialist		2
13	Agro-economist	2	
14	Agro-economist		2
15	Fishery Specialist		3
		33	36
	Supporting Staffs (Non-Key Experts)		27
1	CAD Draftsman – 1		
2	CAD Draftsman – 2		
3	CAD Draftsman – 3		
4	CAD Draftsman – 4		
5	CAD Draftsman – 5		
6	GIS Operator (mapping)		9
7	Project Assistant		9
	Sub-Total 2		*45*
	TOTAL	33	81

Responsibilities and Qualifications of Key Consultants.

1. Team Leader / Irrigation and Water Resources Management Specialist – 9 person-month.

Responsibilities

a) provide overall oversight management and strategic directions, managing DED2 and relationships with PMU-MOWRAM, other relevant ministries, provincial government departments/agencies, AIIB, and other relevant stakeholders, to ensure effective coordination and synergies with all concerned parties, including MOWRAM's other consultants for the project. He/she will be providing overall responsibility for preparing the projects' outputs, managing all experts' inputs, activities, and outputs, and ensuring the consistency between project outputs, and the quality of the system-wide planning exercises, feasibility studies, and other key reports. He/she will also:

b) ensure compliance with project outputs in consultation with AIIB, IFAD, and GCF guidelines.

c) manage the entire DED team, ensuring that all consultants will work closely with each other so that all individual outputs are well integrated, and complement each other to ensure the high quality of the DED and relevant documentation for tendering.
d) preparation of the water balance of (i) the four schemes under Krang Ponley sub-project and (ii) Ou Ta Poung scheme, preparation of water management plan, hydrology report and O&M manuals for Ou Ta Poung, Yutasas, Stung Krang Bat and Brambei Mom and in the context of the other Krang Ponley basin uses and users.
e) monitor the environment, health and safety, quality assurance and control, resettlement and social safeguards aspects to bring minimum delays to the design works.
f) with support from irrigation design engineering and structural design engineers, prepare Bill of Quantity (BoQ) and Engineering Cost Estimate, Technical Specifications, and other required technical documents for required civil work packages.
g) review all aspects of implementation and construction to identify constraints, bottlenecks, concerns, and synergies; and
h) ensure timely delivery of DED and tender package outputs, and of other outputs, following contract requirements.
i) Lead preparation of and ensure all the deliverables and outputs will be delivered with satisfactory quality and on a timely basis.
j) Lead preparation of project progress reports with satisfactory quality, to be submitted to MOWRAM on time.
k) Provide additional support to MOWRAM where required for the preparation and design of the CAISAR Project.

Qualifications:
The team leader will be an expert in the water resources and irrigation management; shall have a Master's degree or higher in Water Resources Management (WRM) and Flood Risk Management (FRM), civil engineering, or related subjects. He/she should have at least 15 years of work experience in irrigation and hydraulic structure design and construction water use and has been team leader in at least two project preparatory services or similar activities in Irrigation design, Water Resources Management (IWRM) and FRM projects in Southeast Asia countries.

2. Irrigation Design Specialist / Deputy Team Leader – (National Position) – 9-person-month

Responsibilities:
a. Review the existing documents (feasibility study reports in which the design option is proposed, topographical survey reports, geotechnical investigation reports, and other existing material), then propose technically and economically viable design concepts for all the 3 irrigation systems with consideration of climate change effects, systemic operation and maintenance, irrigation and drainage efficiency, water productivity.

b. Perform in consultative manner inventory and design for the Ou Ta Poung, Yutasas, Brambei Mom and Stung Krang Bat, including system layouts, irrigation demand for different blocks, canal and drains canal section, water levels in each canal and drain, and designed irrigation scheduling.
c. Assist the Team Leader with coordination and technical direction of the team, including scheduling the expert inputs.
d. Perform the irrigation and drainage design including system arrangement, system operations, and maintenance, irrigation scheduling, and crop water requirement calculation.
e. Provide quality assurance checks of all key engineering calculations and designs.
f. Work with structural design engineering to prepare Bill of Quantity (BoQ) and engineering cost estimates for different civil work packages for the Irrigation Systems.
g. With the structural design engineer, support the Team Leader in preparing Technical specifications for civil work packages.
h. Assist the TL in the preparation of the water balance of (i) the four schemes under Krang Ponley sub-project and (ii) Ou Ta Poung scheme, preparation of water management plan, hydrology report and O&M manuals for Ou Ta Poung, Yutasas, Stung Krang Bat and Brambei Mom and in the context of the other Krang Ponley basin uses and users.
i. For the National Position as Deputy Team Leader, actively monitor progress against the project implementation schedule and deliverables, and coordinate preparation and submission of periodic progress reports and technical reports.
j. For the National Position as Deputy Team Leader, assist PMU in managing, coordinating, and ensuring the high quality of DED Works.
k. In the absence of the Team Leader, the Deputy Team Leader will assume overall management responsibility for the DED2 team, reporting directly to the PMU Project Director/assigned Manager

Qualifications:

The candidate must hold a Master's degree or higher in irrigation design, water resources engineering, hydraulics, hydrology, civil engineering, or a water-related field, and have demonstrated high ability to work in a multi-disciplinary team and excellent communication skills in both Khmer and English. He/she should have at least 12 years of work experience in irrigation and hydraulic structure design and construction water use and have experience as deputy team leader or similar role for two similar contracts in terms of complexity and value in the past 10 years.

3. Irrigation & hydraulic Design Specialist (International Position) – 9-person-month

Responsibilities:

a. Review the existing documents (feasibility study reports in which the design option is proposed, topographical survey reports, geotechnical investigation reports, and other existing material), then propose technically and economically viable design concepts for all the project irrigation systems with consideration of climate change effects,

prioritization of application of nature-based solutions (NBS) such as bio-engineering methods for modernization of the scheme and stabilizing banks of canals, biodiversity and environment risks, systemic operation and maintenance, irrigation and drainage efficiency, water productivity.

b. Assess the appropriate use of dredge spoil depending upon contamination analysis as specified in the safeguards documents; finalizing layout of canals and drains with land owners in the right of way (ROW) of the irrigation schemes including with community forest groups (i.e., for Lum Harch.
c. For one major irrigation scheme, Ou Ta Paong, review the additional withdrawal required (about 20 to 25 cumecs) from the DAMC and KHMC headworks on the Pursat River system that will be undertaken. Assess the adequacy of water remaining in the Pursat River, ensuring no adverse impact on other water bodies within the catchment or on communities dependent on fishing and agriculture.
d. Perform irrigation and drainage system design for the irrigation system including system layouts, irrigation demand for different blocks, canal and drains canal section, water levels in each canal and drain, and designed irrigation scheduling.
e. Perform the irrigation and drainage design including system arrangement, system operations, and maintenance, irrigation scheduling, and crop water requirement calculation.
f. Provide quality assurance checks of all key engineering calculations and designs.
g. Work with the TL in the preparation of the water balance of (i) the four schemes under Krang Ponley sub-project and (ii) Ou Ta Poung scheme, preparation of water management plan, hydrology report and O&M manuals for Ou Ta Poung, Yutasas, Stung Krang Bat and Brambei Mom and in the context of the other Krang Ponley basin uses and users.
h. Work with structural design engineering to prepare Bill of Quantity (BoQ) and engineering cost estimates for different civil work packages for the Irrigation Systems.
i. With the structural design engineer, support the Team Leader in preparing Technical specifications for civil work packages.

Qualifications:

The candidate must hold a Master's degree in water resources engineering, hydraulics, hydrology, civil engineering, or a water-related field, and have demonstrated high ability to work in a multi-disciplinary team and excellent communication skills in spoken and written English. He/she should have at least 10 years of work experience in irrigation design engineering and hydraulic structure design and construction water use and have had such position for two similar contracts in terms of complexity and value in the past 10 years in the Southeast Asia countries.

4. Irrigation and Hydraulic Design Specialist (~~N~~ational Position) – 9-person-month

Responsibilities:

a) The role is required to cover the full range of hydraulic design of various hydraulic structures including, but not be limited to, irrigation and drainage canals and hydraulic structures such as head regulators, cross regulators/check structures, outlet structures, drain outlet and inlet structures, spillway, weirs, etc. The Consultant also shall perform:
b) Work closely with the irrigation design engineer and Team Leader in selecting different types of hydraulic structures required to ensure the most efficiency and effectiveness of the system performance with consideration of the climate change effects and systemic operations and maintenance.
c) Propose design options for canals and drains including side slopes, bed slopes lining materials as well as canal and embankment slope erosion protection.
d) Perform the hydraulic calculation for canals and drain sections, for all types of hydraulic structures to be equipment on the irrigation and drainage networks, and other types of cross-drainage structures required for the farm roads.
e) Assist the TL in the preparation of the water balance of (i) the four schemes under Krang Ponley sub-project and (ii) Ou Ta Poung scheme, preparation of water management plan, hydrology report and O&M manuals for Ou Ta Poung, Yutasas, Stung Krang Bat and Brambei Mom and in the context of the other Krang Ponley basin uses and users.

Qualifications:
Professional civil and structural engineer with a Master's degree in civil engineering and preferably 10 years of experience in designing hydraulic structures, preparing tender documents, BoQ, specifications, and tender drawings is required, and play a similar role for at least two similar contracts in terms of complexity and value over the past 10 years in the Southeast Asia region. S/he must have excellent communication skills in spoken and written English and a demonstrated ability to work in a multidisciplinary and diversified team.

5. Flood and drainage expert (International Position) – 2-person-months

Responsibilities:

a) The Expert will make flood risk assessment and prepare flood management plans and mitigation measures with costs, provide recommendations for infrastructure or nature-based solutions to reduce flood risks and flood damage.
b) The expert will identify and recommend flood control measures (e.g., dikes, levees, dams, embankments, drainage systems) and propose flood-resistant infrastructure and drainage arrangement.
c) Structural measures will include construction of river/lake bank erosion protection structures using cost effective innovative technology, rehabilitation/construction of flood embankments, construction of associated structures and land recovery/river training measures for flood control and prevent/minimize flood damage.
d) Design the flood control and drainage schemes including technology selection, technical design and cost estimate. Technologies and physical design will be selected in due consideration of appropriate vegetation and building with nature type of structures for the locality as well as technical consideration, such as morphology and hydraulics. Results of existing studies should also be carefully examined and evaluated.

e) Advise on technical aspects of flood and river bank erosion works, such as detailed design, updated planning and design, monitoring and evaluation of river responses and maintenance and adaptation of river bank protection works.

Qualifications: The expert should have a Master's degree or higher in Water Resources Management (WRM)/ Flood Risk Management (FRM)/ Civil engineering, or related subjects. He/she should have at least 15 years of work experience in flood control, irrigation and hydraulic structure design and shall have experience in at least two project preparatory services or similar activities for both Water Resources Management and FRM projects in Southeast Asia countries. He should have expertise in hydrological modelling, GIS, and flood risk assessment tools.

6. Flood and drainage expert (National Position) – 3-person-month

Responsibilities: The expert will assist the international expert in;

a) Making flood risk assessment and prepare flood management plans and mitigation measures with costs, provide recommendations for infrastructure or nature-based solutions to reduce flood risks and flood damage.
b) Identifying and recommending flood control measures (e.g., dikes, levees, dams, embankments, drainage systems) and propose flood-resistant infrastructure and drainage arrangement.
c) Designing structural measures which will include construction of river/lake bank erosion protection structures using cost effective innovative technology, rehabilitation/construction of flood embankments, construction of associated structures and land recovery/river training measures for flood control and prevent/minimize flood damage.
d) Designing the flood control and drainage schemes including technology selection, technical design and cost estimate. Technologies and physical design will be selected in due consideration of appropriate vegetation and building with nature type of structures for the locality as well as technical consideration, such as morphology and hydraulics. Results of existing studies should also be carefully examined and evaluated.
e) Advising on technical aspects of flood and river bank erosion works, such as detailed design, updated planning and design, monitoring and evaluation of river responses and maintenance and adaptation of river bank protection works.

Qualifications: The expert should have a Bachelor's degree or higher in Water Resources Management (WRM)/ Flood Risk Management (FRM)/ Civil engineering, or related subjects. He/she should have at least 10 years of work experience in flood control, irrigation and hydraulic structure design and shall have national experience in at least two project preparatory services or similar activities for both Water Resources Management and FRM projects. He should have expertise in hydrological modelling, GIS, and flood risk assessment tools.

7. Structural Design Engineer (International Position)-4 person-months.

Responsibilities:

a. Investigating the structural conditions of the existing irrigation and water management facilities, such as canals, concrete structures, pumps, and gates in the project area.

b. Assess the durability, usability, and suitability of those facilities for future water management.
c. Supervise the topographic surveys and geotechnical investigations and review of the survey results; integrate the findings of the assessment and surveys into the detailed design of the infrastructures.
d. Carry out hydraulic calculations of canal, drain, and hydraulic structures; (i) detailed design of canals, drains, and appurtenant structures; (ii) cost estimation, preparation of BoQs and technical drawings, and completion of all other requirements for award and construction of work contracts; and
e. Provide inputs to the Team Leader and Deputy Team where required.

Qualifications:
The expert must have a Master's degree in civil engineering, water resources or hydraulics engineering. S/he must have at least 10 years of experience in the design of hydraulic structures, including small dams, weirs, and irrigation design systems as well as in-cost estimation and preparation of Bill of Quantities (BoQ) and technical specifications for donor-financed projects. The expert should have experience for two similar projects in terms of complexity and value for the past 10 years in the Southeast Asia region. S/he must have excellent communication skills in spoken and written English and a demonstrated ability to work in a multi-disciplinary team. The consultant will work closely with the Hydraulic Design Specialist and Irrigation Design Specialists.

8. Structural Design Engineer (National Position) – 4-person-month

Responsibilities:
a) Investigating the structural condition of the existing irrigation and water management facilities, such as canals, concrete structures, pumps, and gates in the project area. The role is expected to support and work closely with the international structural design engineer/ specialist.
b) Assess the durability, usability, and suitability of those facilities for future water management.
c) Supervise the topographic surveys and geotechnical investigations and review of the survey results; (iv) integrate the findings of the assessment and surveys into the detailed design of the infrastructures.
d) Carry out hydraulic calculations of canal, drain, and hydraulic structures; (vi) detailed design of canals, drains, and appurtenant structures; (ii) cost estimation, preparation of BoQs and technical drawings, and completion of all other requirements for award and construction of work contracts; and
e) Provide inputs to the Team Leader and Deputy Team where required.

Qualifications:
The experts must have a Bachelor's degree in civil engineering, water resources management or hydraulics engineering. S/he must have at least 5 years of experience in designs of hydraulic

structures, including small dams, weirs, and irrigation systems as well as in-cost estimation and preparation of Bill of Quantities (BoQ) and technical specifications for donor-financed projects. The expert should have experience for two similar projects in terms of complexity and value for the past 10 years in the Southeast Asia region. S/he must have good communication skills in both Khmer and English and a demonstrated ability to work in a multi-disciplinary team. The consultant will work closely with the other specialists, including Design Specialist and Irrigation Design Specialists.

9. Resettlement Specialist (International Position) – 3-person-month

a. Working closely with designing team to explore the possible alternatives to avoid land acquisition and resettlement impacts. If it is not possible to avoid – discuss the measures to minimize/mitigate the land acquisition and resettlement impacts of the subprojects.
b. Assisting MOWRAM and GDR-MEF in the land acquisition and resettlement surveys and public consultations.
c. Assisting with preparation of the right of way (ROW) or reservation width alignment drawings.
d. Closely working with and assisting the GDR-MEF in preparing the Detailed Resettlement Plans (DRP) with the GDR. Ensuring timely submission of DRPs to the Inter-ministerial Resettlement Committee (IRC) and the financiers.
e. Assisting MOWRAM in planning, implementation and monitoring of voluntary land donation, if any. Assisting MOWRAM to prepare the Community Participation Plans for the provinces if there is voluntary land donation for the subprojects.
f. Monitoring of land acquisition and resettlement activities during construction with guidance from MOWRAM Focal Point. Monitoring and reporting on planning and implementation of voluntary land donation for the subprojects.
g. Identifying if there are ethnic minority communities living in and/or are affected by the subproject implementation.
h. Ensuring that a Grievance Redress Mechanism (GRM) is in place and effective whereby affected persons (AP) may have their claims registered. Assisting MOWRAM in settling of complaints and grievances.
i. Assisting MOWRAM in establishing the system/database to monitor of land acquisition and resettlement as well as voluntary donation for the Project.

Qualifications: Master's degree in social science/ management or relevant field and preferably with 8-year experience dealing with land acquisition and involuntary resettlement for similar projects - with at least 5 projects preferably funded by Development Partners such as AIIB, IFAD, etc.). Experiences with updating of resettlement plans and preparation of detailed Resettlement Plans in Cambodia are preferable. Candidate must have excellent communication skills in spoken and written English and a demonstrated ability to work in a multidisciplinary and diversified team.

10. Resettlement Specialist (National Position) – 3-person-month

a. Together with the International Resettlement Specialist working with designing team to explore the alternatives to avoid land acquisition and resettlement impacts. If it is not possible to avoid – discuss the measures to minimize/mitigate the land acquisition and resettlement impacts of the subprojects.
b. Supporting the International Resettlement Specialist, MOWRAM and GDR in conducting of the land acquisition and resettlement surveys and public consultations.
c. Participating the preparation of the right of way (ROW) or reservation width alignment drawings
d. Assisting the International Resettlement Specialist and GDR-MEF in preparing the Detailed Resettlement Plans (DRPs). Ensuring timely submission of DRPs to the Inter-ministerial Resettlement Committee (IRC) and the financiers.
e. Assisting MOWRAM in planning, implementation and monitoring of voluntary land donation, if any. Assisting the International Resettlement Specialist and MOWRAM to prepare the Community Participation Plans for the provinces if there is voluntary land donation for the subprojects.
f. Assisting the International Resettlement Specialist and MOWRAM to monitor land acquisition and resettlement activities during construction with guidance from MOWRAM Focal Point. Assisting the International Resettlement Specialist to monitor and prepare monitoring reports on planning and implementation of voluntary land donation for the subprojects.
g. Together with the International Resettlement Specialist to identify if there are ethnic minority communities living in and/or are affected by the subproject implementation.
h. Ensure that a Grievance Redress Mechanism (GRM) is in place and effective whereby affected persons (AP) may have their claims registered. Assisting MOWRAM in settling of complaints and grievances.

Qualifications: Bachelor's degree in social science/ management or relevant field and preferably 5 years of work experience as Resettlement Specialist dealing land acquisition and involuntary resettlement with similar projects (with at least 3 projects preferably funded by Development Partners such as AIIB, IFAD, etc,). Candidate must have experiences on preparation of detailed Resettlement Plans in Cambodia and working with GDR. Candidate must have excellent communication skills in spoken and written English and a demonstrated ability to work in a multidisciplinary and diversified team.

11. Agriculture Specialist (International Position) – 2-person-month

a. Review the proposed cropping patterns and agricultural support packages for respective irrigation system.

b. Conduct a field assessment to reconfirm the proposed cropping patterns and cropping areas for the irrigation systems. The final cropping patterns will be used by the irrigation design engineer to plan and design irrigation distribution networks and drainage systems, and to design irrigation scheduling for different irrigation blocks for different cropping seasons.
c. Review and propose optimal cropping patterns and agricultural support packages for the irrigation systems with consideration of climate change effects (flood and drought resilience), water availability and market demand.
d. Work closely with agriculture economists to provide support for economic analysis for each investment.
e. Provide support to the Team Leader in preparation of the recommendations for the design of the irrigation systems.

Qualification: The experts must have at least a Master's degree in agriculture, agronomy, or related fields and at least 10 years of experience in irrigated agriculture, estimating crop water availability and requirements, designing cropping patterns and cropping intensities, including substantial experience in the Southeast Asia region, and for two similar project for the past 10 years in the Southeast Asia region. S/he must have excellent communication skills in spoken and written English and a demonstrated ability to work in a multidisciplinary and diversified team.

12. Agriculture Specialist (National Position) – 2-person-month

a. Review the proposed cropping patterns and agricultural support packages for respective irrigation system.
b. Conduct a field assessment to reconfirm the proposed cropping patterns and cropping areas for the irrigation systems. The final cropping patterns will be used by the irrigation design engineer to plan and design irrigation distribution networks and drainage systems, and to design irrigation scheduling for different irrigation blocks for different cropping seasons.
c. Review and propose optimal cropping patterns and agricultural support packages for the irrigation systems with consideration of climate change effects (flood and drought resilience), water availability and market demand.
d. Work closely with agriculture economists to provide support for economic analysis for each investment.
e. Provide support to the Team Leader in preparation of the recommendations for the design of the irrigation systems.

Qualification: The experts must have at least a Master's degree in agriculture, agronomy, or related fields and at least 5 years of experience in irrigated agriculture, estimating crop water requirements, designing cropping patterns and cropping intensities, including substantial experience in the Southeast Asia region. S/he must have excellent communication skills both in Khmer and English and a demonstrated ability to work in a multidisciplinary and diversified team.

13. Agriculture Economist (International Position) – 2-person-month

The International Agriculture Economist will be responsible for preparing a cost-benefit analysis of the AIIB-financed investments in each scheme, compliant with the requirements of AIIB, IFAD, and GCF. The specialist will be working closely with national agriculture specialist and design engineers to understand the investment scenario and benefits stream of each investment, especially for the irrigation systems. Provide support to the Team Leader in preparing recommendations for the design of the irrigation systems.

Qualification: The Economists must have a Master's degree in rural/agricultural economics and at least seven 7 years' international experience in conducting cost-benefit analysis of public water infrastructure investments, including substantial previous experience of cost-benefit analysis of irrigation investments. The expert should have experience for two similar projects in terms of complexity and value for the past 10 years in the Southeast Asia region. S/he must have excellent communication skills in spoken and written English and a demonstrated ability to work in a multidisciplinary and diversified team.

14. Agriculture Economist (National Position) – 2-person-month

The National Agriculture Economists will be responsible for preparing a cost-benefit analysis of the AIIB-financed investments in each scheme, compliant with the requirements of AIIB, IFAD, and GCF. The specialist will be working closely with the international agriculture economist, agriculture specialists and design engineers to understand the investment scenario and benefits stream of each investment, especially for the irrigation systems. Provide support to the International Agriculture Economist and to the Team Leader in preparing recommendations for the design of the irrigation systems.

Qualification: The National Agriculture Economists must have a Master's degree in rural/agricultural economics and at least 5 years' national experience in conducting cost-benefit analysis of public water infrastructure investments, including substantial previous experience of cost-benefit analysis of irrigation investments. The specialist must have a good knowledge and sound communication skills both in Khmer and English and be able to work in multidisciplinary and diversified team.

15. Fishery Specialist (National Position) - 3-person month

The National Fishery Specialist will work closely with MOWRAM, MAFF, PDWRAMs, and PDAFFs of all the irrigation schemes provinces (Pursat, Kampong Chhnang, Kampong Speu, and Kandal) to prepare detailed designs for the fish-ways, and with the support of the engineering staff in the team, develop cost estimates, engineering drawings, and bidding documents; to work closely with hydraulic structural design engineer. The designs shall be

prepared based on consultation with district and village officials, water user groups and fisher-folk, and most important with key considerations for biodiversity (habitat fragmentation, species-specific challenges) and environmental risks (sedimentation and hydraulic impacts).

Qualification: The specialist shall have a bachelor's degree in fishery and have previous experience of fishway design and construction. The specialist must have a good knowledge and sound communication skills both in Khmer and English and be able to work in multidisciplinary and diversified team.