

# TERMS OF REFERENCE

OFFICIALLY TITLED AS:

**THE SCALING UP CLIMATE RESILIENCE GRANT IN  
CAMBODIA THROUGH THE INNOVATIVE  
DECENTRALIZED WATER SOLUTION**

**TO PROVIDE SAFETY AND RESILIENCE FOR RESIDENTIAL  
WATER SYSTEM PROJECT**

**December 2020**





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# **TERMS OF REFERENCE (TOR)**

**1. INTRODUCTION**

**2. TERMS OF REFERENCE (TOR)**



# 1 Introduction

This **Terms of Reference ("TOR")** describes and specifies the contents of the **Assignment** the **Consultant** shall perform hereunder.

The **Assignment** is largely subdivided into "*Subsections 2.1 Field & Site Survey and 2.2. Detailed Design ("DD")*". "*Subsection 2.3 Work Outputs*" specifies the list of work outputs the **Consultant** shall produce and submit after having performed the **Assignment**.

K-water may provide technical assistance and comments based on the work outputs produced by the consultant.

## 2 Terms of Reference ("TOR")

### 2.1 Field & Site Survey

The **Consultant** shall carry out a field & site survey that constitutes this **Assignment**. In doing so, the **Consultant** shall conduct a technical review and further design, and make the most of, the work outputs produced at the stage of **Basic Design ("BD")**, and shall additionally perform any necessary works on changes as needed for any plans that was proposed in the BD (including required surveys as below). This would be helpful in considering local needs better into this **Assignment**.

#### 2.1.1 Performance of Preliminary Survey

- (1) Basic Surveying
  - Topographic surveying
  - Pipeline route surveying
- (2) Geological & Geotechnical Survey
  - Borehole survey
  - In-situ test
  - Laboratory test
  - Materials availability survey (if necessary)

#### 2.1.2 Performance of Compensation Survey

- (1) Environmental screening
- (2) Social screening

- (3) Other compensable assets (incl. utilities/underground utilities)
- (4) Estimation of compensation costs

### **2.1.3 Performance of Other Required Surveys (Permit-Related Requirements)**

- (1) Relevant law and Regulation
- (2) (if necessary) Requirements of Government

## **2.2 Detailed Design ("DD")**

### **2.2.1 Review & Improvement of Conceptual Plan ("CP") Work Outputs**

- (1) Before proceeding to the performance of **DD**, the **Consultant** shall review the work outputs of **Conceptual Plan ("CP")** produced for each of work parts (incl. civil works, architectural works, mechanical works, electrical works, instrumentation & control facilities, and landscaping works), together with the contents of policy projects at a level of the central or local government and any other project-related environment, and then shall improve them wherever necessary.
- (2) If an initial environmental examination, prediction and assessment or feasibility analysis of any selected location indicates that the location is not appropriate or environmental impacts will be caused at the location, the **Consultant** shall ensure to formulate a proper environmental protection plan, which shall be contained in the **DD**.
- (3) The **Consultant** shall ensure that its technical review of **BD** work outputs addresses the following contents:
  - ① Review basic data/materials used to determine the capacity of water supply systems, which contain:
    - A. Target service area;
    - B. Target year;
    - C. Served population;
    - D. Water demand/supply;
    - E. Water source(s); and
    - F. Design capacity
  - ② Review relevant plans regarding design capacity determination:



- A. Upper-level plans and water supply plans;
  - B. Facilities plans proposed in relation to existing and future water supply systems; and
  - C. O&M and expansion plans proposed in relation to existing water supply systems, including historical data on how they have been operated and maintained
- ③ Review data/materials used to formulate a water supply plan, which contain:
- A. Needs/requests of a local government(s)
  - B. How to ensure stable water supply;
  - C. Water distribution plan;
  - D. Phase expansion plan;
  - E. determine the locations and structures of water supply systems,
- ④ Review data/materials used to determine the locations of water supply systems, which contain:
- A. Location of water abstraction (i.e. location at which raw water is abstracted/taken in from a water source);
  - B. Location of WTP;
  - C. Pipeline route (for raw & treated water mains); and
  - D. Location of lift pumping station, etc. to control water pressure for stable water supply
- ⑤ Review data/materials used to determine water treatment methods/processes, which contain:
- A. Future water quality of water source;
  - B. Target (or design) water quality;
  - C. Water treatment process (to produce treated water);
  - D. Wastewater treatment process (to treat wastewater before it's discharged);
  - E. Types of unit water treatment processes (treated water/wastewater); and
  - F. How to dispose of sludge generation
- ⑥ Review design details/contents, which contain:
- A. Design criteria employed for each work part;
  - B. Layouts of facilities/structures;
  - C. Types & capacities of facilities/structures;
  - D. Automation level of water treatment facilities and appurtenances;
  - E. Types and layouts of buildings and offices;

- F. Alternative plans for each work part;
- G. Design drawings and calculations of main structures/facilities; and
- H. Other design issues related to water supply systems

### **2.2.2 Performance of Detailed Design (“DD”)**

- (1) The **Consultant** shall perform a **DD** for each of work parts (incl. civil works, architectural works, mechanical works, electrical works, instrumentation & control facilities, and landscaping works) after having reviewed the **CP** work outputs to determine optimal plans for those work parts. The **DD** work outputs shall include design documents that will be used for the bidding process at the construction stage.
- (2) The following sub-clauses ① to ⑥ describe target structures and design items for each of work parts that shall be addressed at the **DD** stage, and the details are subject to change in the process of the **DD**.

#### I. Common

##### A. Target structures & facilities

- ① Intake facilities (incl. intake station)
- ② Lift pump station, and raw & treated water mains (incl. appurtenances)
- ③ Water treatment facilities (incl. WTP)
- ④ Electrical, architectural and mechanical facilities
- ⑤ Building & landscape
- ⑥ Construction facilities
- ⑦ Quality and safety monitoring equipment and facilities

##### B. Design items

- ① Design plan for each work part
- ② Sizes & layouts of structures and facilities
- ③ Types & capacities of structures and facilities
- ④ Types & layouts of buildings & office spaces
- ⑤ Alternative plans for each work part
- ⑥ Design drawings & calculations of main structures & facilities
- ⑦ Topographic digital maps
- ⑧ Quality guarantee issues
- ⑨ Cost estimation (construction costs)

- ⑩ O&M guideline for each facility/work site
- ⑪ Project plan & design work outputs
- ⑫ Stabilization plan

## II. Civil works

### A. Target structures & facilities

- ① Structures & facilities for intake and booster pumps
- ② Structures & facilities for water/wastewater treatment facilities (to produce treated water/to treat wastewater)
- ③ Raw & treated water mains and appurtenances
- ④ Piping on the premises of WTP
- ⑤ Access road & service road
- ⑥ Other appurtenances

### B. Design items & calculations

#### (A) Intake station, WTP, and lift pump station

- ① Capacity & hydraulic analysis of structures
- ② Foundation & structure calculations
- ③ Land clearing plan & slope stability analysis
- ④ Earthwork plan (in association with water mains)
- ⑤ Measures to remove freshwater mussels from raw water mains (e.g. chlorine dosing)
- ⑥ Entire plan view
- ⑦ Schematic diagram of water treatment processes
- ⑧ Hydraulic profile
- ⑨ Longitudinal profile & cross section of earth works
- ⑩ Plan view, sectional view, bar arrangement drawing, piping drawing and detail drawing (of structures)
- ⑪ Access road & service road
- ⑫ Waterproofing method (for structures)
- ⑬ Piping on the premises of WTP
- ⑭ Stability analysis (in terms of flooding, fire, power outage, system failure, etc.)

#### A. Other required design items/data/drawings

- (B) Raw & treated water mains
  - ① Pipeline route
  - ② Pipe diameter, type and thickness
  - ③ Hydraulic calculation, water hammer analysis, water hammer prevention
  - ④ Locations, sizes and types of appurtenances (e.g. valve)
  - ⑤ Profile & plan views
  - ⑥ Design calculations & drawings, as through a stability analysis of existing structures, e.g. railways, culverts and roads (highway, national road), and temporary facility considering groundwater table and results of a geological survey on river sections and other sections passing through soft ground
  - ⑦ Pipe foundation & protection works
  - ⑧ Installation of boundary stone marks
  - ⑨ Pipe laying environment
  - ⑩ Road dedicated to the maintenance of water supply systems (if necessary)
  - ⑪ Spoil use plan (in association with WTP)
  - ⑫ Individual design drawings for various valve seals
  - ⑬ Other required design items/data/drawings

### III. Mechanical works

- A. Target facilities & equipment/apparatuses
  - ① Intake and booster pumps
  - ② Raw & treated water mains
  - ③ Water treatment facilities (to produce treated water)
  - ④ Effluent treatment facilities (to treat effluent)
  - ⑤ Water hammer cushion (if necessary)
  - ⑥ Vibration sensor (if necessary)
  - ⑦ Construction facilities (if necessary)
  - ⑧ Other required facilities & equipment/apparatuses
- B. Design items & calculations
  - ① Schematic diagram of each facility
  - ② Types, capacities and numbers of equipment/apparatuses
  - ③ Characteristic curves of equipment/apparatuses

- ④ Materials & features of main parts of equipment/apparatuses
- ⑤ Piping and instrumentation diagram (P&ID)
- ⑥ Plan & vertical views of piping works, layout drawings of equipment/apparatuses
- ⑦ Detailed plan view & sectional view
- ⑧ Water supply & distribution line diagram for each floor, installation drawings of equipment/apparatuses
- ⑨ Specification & detailed drawing of each system equipment/apparatus
- ⑩ Lists of equipment/apparatuses, materials and parts
- ⑪ Welding, painting and coating
- ⑫ Installation heights for various pumps,
- ⑬ Other required design items/data/drawings

#### IV. Electrical works

##### A. Target facilities & devices/apparatuses

- ① Power receiving & transforming system
- ② Electric power system
- ③ Indoor and outdoor backbone cabling
- ④ Lighting system
- ⑤ Grounding system
- ⑥ Lightning protection system
- ⑦ Redundant power supply
- ⑧ Emergency generator
- ⑨ Emergency alert system
- ⑩ Electric facilities for construction
- ⑪ Lightning shielding system for buildings
- ⑫ Other required facilities & devices/apparatuses

##### B. Design items & calculations

###### (A) Type of power receiving line, power receiving voltage

- ① Economic feasibility analysis to select optimal type (dedicated line or general line) and voltage

###### (B) Types, capacities and rating of electric devices/apparatuses

- ① Capacity of transformer, configuration of transformer banks

- ② Pump motor starting method
- ③ Applicability of variable-speed pumps to alleviate the voltage drop of transformers and to protect motors
- ④ Configuration & setting of protective relay
- ⑤ Capacity of emergency generator, transfer method
- ⑥ Lightings (illuminance)
- ⑦ Cable capacity & size
- ⑧ Capacity of DC power supply, etc.
- (C) Block diagram of facility operations (incl. facility linkage)
- (D) Grounding diagram
  - ① Grounding methods (isolation grounding, common grounding, etc.) & surge protection measures
- (E) Outside view & layout drawing of electrical devices/apparatuses
- (F) Circuit diagrams of power receiving & transforming system, panel board and switch board
- (G) Single- and three-line diagrams
- (H) Power distribution plan (incl. reviewing whether to introduce a utility tunnel for a WTP, power distribution methods, etc.)
- (I) Configuration of switchgear by type (i.e. indoor and outdoor substations)
- (J) Overcurrent relay, ground relay, and other measures to protect a protective relay
- (K) Features of main loads (load factor, operation method, automation level, etc.)
- (L) Detailed drawings of main parts
- (M) Wiring diagrams of lightings, electric heating devices and power piping works (incl. schematic diagrams)
- (N) Other required design items/data/drawings
- C. Stabilization of electric facilities
  - (A) Configuration of electric power facilities against power outage
    - Reserve capacity for emergency use (which shall be considered in determining the installed capacity of generators)
    - Separation of high-voltage busbar series in configuring a pump motor control center

## V. Architectural works

### A. Target buildings & facilities

- ① Main building
  - ② Chemical dosing house
  - ③ Filter bed house
  - ④ Transmission pump house
  - ⑤ Chlorine dosing house
  - ⑥ Dehydrator house
  - ⑦ Guard office & post
  - ⑧ Main entrance and appurtenances
  - ⑨ Warehouse
  - ⑩ Ventilating & service openings for clear well, staircase for each structure
  - ⑪ Intake pump house
  - ⑫ Lift station
  - ⑬ Emergency generator room
  - ⑭ Other required buildings & facilities
- B. Design items & calculations
- ① Building layout (incl. profile & cross section of land, cadastral map, vicinity plan, layout adjustment plan)
  - ② Perspective view & aerial view (considering coloring & landscaping works)
  - ③ Plan view & 4-sided vertical view of each floor (incl. basement)
  - ④ Sectional view, detailed view of each part (incl. basement)
  - ⑤ Structural diagram, bar arrangement diagram, and column center diagram
  - ⑥ Installation drawings of various equipment
  - ⑦ Plan view of doors & windows, door & window schedule
  - ⑧ Structural floor plan view, ceiling plan view
  - ⑨ Finishing schedule, structural calculation of buildings
  - ⑩ Stabilization pond and appurtenances
  - ⑪ Other design items/data/drawings

## **2.3 Supervision and Work Outputs**

### **2.3.1 Supervision of construction work**

The Consultant will assist NCDD-S in effectively supervise every aspect of the construction work, ensuring full compliance with this ToR, and with technical support from K-water. The supervision activities are, *inter alia*, as below:

- ① Collecting schedule and workplan of the contractor
- ② Undertake regular spot checks of the contractor’s work based on the detail design/ToR
- ③ Ensure effective monitoring of performance and compliance with design/ToR
- ④ Producing monthly supervision reports on performance of contractor,
- ⑤ Closely work with commune councils, district governor, and provincial governor on project and ensure proper monitor and reporting of the construction work activities

### 2.3.2 Production & Submission of Work Outputs for Separate Assignment Unit(s)

In prior consultation with **K-water**, the **Consultant** shall determine kinds of work outputs that need to be separately produced for any individual unit(s) of the **Assignment**, and then shall produce & submit the corresponding work outputs.

### 2.3.3 Handling of Data Acquired & Used for the Assignment

As instructed by the **Supervisor**, the **Consultant** shall ensure that data collected and directly or indirectly used for the **Assignment** are contained as annexes to its work outputs or that they are submitted separately.

### 2.3.4 List of Work Outputs, Staffs & Payment of Service Fee for the Assignment

The work outputs of this **Assignment** are listed in the following table, which the **Consultant** shall produce and submit hereunder. The Consultant shall be paid for the work outputs of the Assignment at contract prices as specified in the Statement of Items, which are classified into two different kinds of cost categories as shown below:

- (1) Cost categories accompanying the incurrence of printing costs, etc.
  - ① List of Work Outputs

Item	Quantity (copy or set)
(1) Reports	



Item	Quantity (copy or set)
① Final Report (full) ② Final Report (summary) ③ Final Report (appendix or annex) ④ Surveying Report ⑤ Geological & Geotechnical Survey Report ⑥ Construction Schedule ⑦ O&M (Operation & Maintenance) Guideline ⑧ Compensation Survey Report	02 (copy/copies) 02 (copy/copies) 02 (copy/copies) 02 (copy/copies) 02 (copy/copies) 02 (copy/copies) 02 (copy/copies)
(2) Calculation Reports ① Hydraulic & Capacity Calculation Report ② Foundation & Structure Calculation Report	02 (copy/copies) 02 (copy/copies)
(3) Bidding Documents ① Site Description ② Special Terms & Conditions of Construction Contract, and Construction Specification ② Fabrication & Procurement Specifications of Materials & Equipment ④ Drawings A. Design Drawings (A1-size) B. Design Drawings (A3-size, in CAD format) ⑤ Design Cost Estimates A. Statement of Items (in accordance with the QTO (Quantity Take Off) Criteria established by the government) B. Schedule of Rates (or Cost Breakdown Table) C. Unit Cost Estimate D. Bill of Quantities (BOQs)	03 (copy/copies) 03 (copy/copies) 03 (copy/copies) 03 (copy/copies) 03 (copy/copies) 03 (copy/copies) 03 (copy/copies) 03 (copy/copies)
(4) Other Work Outputs ① Other Survey Outputs Site Map (A3, in CAD format) ③ Topographic Cadastral Map for Acquiring Construction Permit ④ Project Status Diagram	1 (set) 03 (copy/copies) 1 (set) 1 (set)
⑤ Aerial (or Bird's-Eye) View ⑥ Water Supply & Distribution Line Diagram ⑦ Reports (Portable Storage Device: USB, etc.) ⑧ Photo Album (Portable Storage Device: USB, etc.) ⑨ Miscellaneous Materials/Data (5) Supervision output ① Release technical report for the first payment of contractor ② Release technical report for the Second payment of contractor ③ Release technical report for the Third payment of contractor	1 (set) 1 (set) 1 (set) 1 (set) 1 (set) 3 (set) 3 (set) 3 (set)
(6) Duration of the assignment ① Basic and Detail Design phase ② Construction supervision	<b>06(Months) Until the construction completed</b>

\* The quantities of work outputs as specified in the table include those of their interim and final versions. In this case, the interim version of a work output also includes its version for review.

- (2) The design consulting package shall be provided by a company with extensive experience in survey, design and construction supervision of rural road and irrigation works.

The firm will assign sufficient and well-qualified staff to implement the services on time and make available to them satisfactory office accommodation, adequate means of transport, good quality survey equipment and adequate office equipment and facilities (including adequate numbers of computers and appropriate software).

The table below indicates the number and type of staff needed to complete the contract.

**Table 2: Staff required**

Position	No. needed	Qualifications	Minimum experience	Other requirements
<b>Key Staff Required</b>				
Team Leader / Civil Engineer	1 (full time)	Bachelor & Master degree in civil Engineering or similar relevant qualifications from a recognized institution.	Ten years professional experience including at least 2 years in Team Leader or equivalent role At least 5 years experience in design of water hydraulic projects including Clean Water Management with significant experience in climate change adaptation projects	Must be a good administrator, have excellent communication skills, good spoken and written English and the ability to write comprehensive, well-structured reports.
Assistant Design Engineer	2 (Full time)	Bachelor degree in civil engineering or equivalent.	Five years experience of design and implementation of clean water infrastructure. Experience with climate change projects an advantage.	Able to use computer aided design (CAD) facilities in the preparation of designs and drawings. Able to read and communicate in English

- (3) Cost categories for permit-related documentary requirements<sup>1</sup> to be submitted together with “Other Work Outputs”

Item	Quantity
(1) List of Compensable Assets	
① Lands (State-/Publicly-Owned Lands, Farmland, Forest Land, etc.)	00 (copy/copies)
② Other Compensable Assets	1 (set)
(2) Official Announcements	1 (set)

<sup>1</sup> Production & submission of permit-related documentary requirements: Paid on a basis of one set

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Item	Quantity
(3) Materials for Deliberative Process	1 (set)
(4) Permit-Related Materials	1 (set)
(5) Data/Materials Acquired during Mutual Consultation & Discussion (incl. Official Letters/Documents)	1 (set)
(6) Other Relevant Data/Materials	1 (set)