

Terms of Reference (ToR)

for consultancy on feasibility study & Detail Engineering Drawing on appropriate water supply technologies in climate risk hot spots of coastal Areas

Service Package-RWSHP-SD-20

1. Background

Climate change is a serious threat to the countries with high concentrations of population and less empowered economic activity of coastal regions. The potential impacts of climate change on coastal areas include progressive inundation from sea level rise, heightened storm damage, loss of wetlands, and increased salinity from saltwater intrusion. The implications of climate change for saltwater intrusion and its impact on livelihoods and adaptation alternatives have not been investigated in great detail (World Bank 2009). However, sporadic measurement of soil and water salinity along coastal areas indicates intrusion of saline waterfront landward in many areas (Mohal et al. 2006). Anecdotal evidence also indicates that increased salinity from saltwater intrusion poses an imminent threat to livelihoods and public health through its impacts on agriculture, aquaculture, infrastructure, coastal ecosystems, and the availability of freshwater for household and commercial use (DFID 2007; Hussain 2008). The problem of saltwater intrusion is expected to become more severe in low-lying coastal areas throughout the world, with increased sea level caused by climate change (Bates et al. 2008; Akhter 2012).

Due to climate change, the groundwater-based water supply in the coastal areas of Bangladesh have been experiencing various significant issues like: principally arsenic sullyng, bringing down of the water table, salinity and unavailability of reasonable aquifers (PDO-ICZMP, 2004) etc. The extent of utilizing ground water source for improved drinking water was 97.9% in 2012-13, 98.5% in 2013 and 86.9% in 2015 respectively (Bangladesh Bureau of Statistics, 2014; BBS, 2015; World Bank, 2016). Lack of safe drinking water has been identified as prime scarcity in the daily life of the coastal population (Islam and Ahmad, 2004). Arsenic contamination and salinity in water make the situation difficult for supplying potable water to the community of the country.

In the coastal areas of Bangladesh, the deficiency of drinking water is intense as the freshwater aquifers are not available at reasonable depths and the surface water is profoundly saline and turbid (Islam et al., 2014). In coastal belt and southern part of the country, shrimp farming has been increased over the past two decades by essentially changing the local land use, and adversely influencing surface and groundwater resources (Datta et al., 2010). WHO (2004) found that the groundwater is inadmissible for human consumption due to high salinity in the south- J. Environ. Sci. & Natural Resources, 11(1&2): 17-25, 2018 ISSN 1999-7361 18 western region of the country (Khulna, Satkhira and Bagerhat district). Further, Ali (2006) reported that, saline water intrusion has caused issues in terms of severely declining the supply of potable water. Both surface and groundwater have been polluted by saline in this area. For this, rainwater is the most suitable for meeting drinking water needs. Islam (2015) also reported that rain water harvesting system (RWHS) is an important innovative livelihood option for safe drinking water in the exposed salinity-prone coastal area. The dwellers can collect water in monsoon and use for next five months in drought season only for drinking purpose. But improper maintenance makes it unhygienic. People of this area mainly consume water from pond sand filter (PSF) and a little number of tube well (hand pump deep tube-well), where the presence of sweet or tolerable saline layer of water. The potable water supply from PSF is an important source of water for the community of the coastal area of the country (Moniruzzaman and Rahman, 2011; Moniruzzaman et al., 2012).

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The PSFs don't function properly round the year due to the lacking of water supply and other functional problems. Most of the dwellers use pond water for their drinking purpose by mixing with alum (potassium aluminum sulfate), without thinking about the purity.

The Rural WASH through HCD Project is a noted step of the World Bank's support designed to help the government to achieve better human resource development outcomes through WASH interventions and uses a convergence approach. The proposed project will invest in WASH infrastructures that meet the 'safely-managed' service standard and in WASH sector development that will ensure engagement of LGIs and participation of private sector to provide sustainable and improves WASH services. The project will be supported through Investment Project Financing (IPF) on IDA terms. The government has committed to investing in 'safely-managed' WASH facilities, which are in line with the service standards needed for meeting the target of 'SDG 6' and maximizing human capital development.

The project will support a sub-component to conduct comprehensive mapping survey and water supply feasibility studies on appropriate water supply technologies in severely water scarce areas in climate risk hot spots of 13 coastal Districts in Southern Bangladesh. DPHE, the lead agency of the project would like to hire consultancy and invite "Expression of Interest (EoI)" from the professional research institution/ organization, engineering consultancy firm to undertake the above assignment.

2. Objectives of the Assignment :

The objectives of this consultancy assignment are:

- Identify the water-scarce area of a coastal community of Bangladesh;
- Assessing the Domestic Water Demand of the Coastal Community.
- Identify the specific constraints of drinking water supply in the coastal area.
- Identify sustainable sources of water supply to meet the future demand and provide safe water from those sources.
- Test effectiveness of the existing technological options and modify design of existing options.
- Construct (testing) of different Types of Water Supply Options for feasibility & sustainability of technological options.
- Identify suitable water treatment option based on the source water quality with special focus on pipe water supply.
- Determine Climate resilient infrastructure development to treat and distribute water from the sources by using improved/ modified water technology.
- Assess social and environmental impact of the development works.
- Outline design for water supply options and cost estimation analyze with financial and economic feasibility of the options.

Area of the Study:

Feasibility studies on appropriate water supply technologies in severely water scarce areas in climate risk hot spots of 13 coastal Districts in Southern Bangladesh. Coastal areas are Khulna, Bagerhat, Satkhira, Jessore, Narail, Pirojpur, Jhalokathi, Barguna, Barisal, Patuakhali, Bhola, Shariatpur, Gopalganj.

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3. *Scope of Services, Tasks (Components) and Expected Deliverables*

The scope of work of the study includes, but not limited to the followings:

Phase I: Preliminary and detailed study

- **Review of Previous Studies and Secondary data collection:** Previous rural & urban based studies will be reviewed and data to be collected can include the type, location, and capacity of water supply, water-treatment assets; water service coverage, inventory of existing water facilities. Socioeconomic data to be collected include population density, population trends, the location of slums, development plans and zoning resolutions; Data to be collected on physical characteristics include topography, land use, roads, ground contour, water resources etc.
- **Primary data acquisition:** Where data are observed insufficient, baseline survey will be conducted on water use, water sources, land level (as required), water quantity and quality, and other relevant data to determine current condition for assessment of the study. To assess groundwater condition geological investigation or drilling will be carried out where necessary. Hydrogeologic Investigation will be done for minimum 25 worst locations for ground water.
- **Source identification:** Identification and assessment of probable sources for potential Climate resilient water supply including groundwater, rivers, springs and ponds. The consultants shall use surface water, groundwater and rainfall runoff models for identification and assessment of probable sources for water supply for urban & rural areas. The assessment will include water quality and water availability of the sources. The extent of saline intrusion in ground water and surface water will be assessed to determine maximum safe yield especially from the aquifer. **Study of existing technological options:** Evaluation of various alternatives of sources and technological options based on national policy and standards in terms of quantity and quality using models, cost effectiveness in development of various sources, system supply reliability, system uncertainties, operational complexity, environmental impacts and social acceptability based on the concept of Climate resilience.
- **Study of water treatment requirement:** Based on findings from water quality analysis water treatment process for urban & Rural areas will be selected for different water sources. The suitability of different water supply technologies in terms of technical feasibility and operation & maintenance will be assessed.
- **Transmission and distribution system:** Water transmission and distribution network will be assessed with the proposed water supply sources from the current study.
- **Mapping:** Prepare a digital map of the assessment results using geographic information system (GIS) technology. The GIS-based digital map will show physical, social, infrastructure features of the study area and also various model results. 80 upazilas GIS mapping for feasible water supply options will be done.
- **Demand assessment:** The future population of study area (rural & urban) up to 2045 will be estimated. Based on the population projection water demand will be assessed for future scenarios. The assessment shall include daily and seasonal variation of water demand. The study will review this demand for water by households, commercial, and other entities etc.

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- **Required developments:** Assessment of future water treatment, transmission and distribution system requirement including but not limited to different Water Options, intakes and treatment plants, reservoirs, OHTs, water distribution mains and distribution network, consumer connections etc for Urban & rural area. The assessment and preliminary design of the climate resilient water supply options with transmission and distribution system will be done by using mathematical model. Modify design of existing water supply options for making user friendly and sustainable delivery of safe and potable water in urban & rural areas.
- **Environmental and social assessment:** In order to understand the environmental and social implication of the water supply and sanitation development project, Environmental Impact Assessment / Social Impact Assessment will be done for the project area.
- **Seminar:** Seminar will be conducted for dissemination of study findings at national level (venue in a 5 star hotel and Seminar will be conducted in Dhaka) and zonal level (venue in a 3 star hotel and Seminar will be conducted in Khulna and Barishal) and with sector experts and national stakeholders (Minimum participants number will be 50).
- **Financial and Economic analysis:** Based on the outline design, the project/ scheme cost will be estimated and required financial and economic analysis will be done to justify the investment which will include: EIRR, IRR, BCR etc.

Phase II: Engineering Designs and Bid documents

- Preparation of Detailed engineering design of the water supply system.
- Preparation of Engineering/ technical drawings.
- Preparation of Engineers Estimates using standard bills of quantities
- Preparation of Technical Specifications for construction works
- Preparation of Bid documents for construction of the works.
- Preparation of Detailed Implementation schedule.
- Schedule of Equipment.

5. Methodology

The detail methodology of the carrying out the above activities under the scope of services will be designed by the Consultant and will be proposed in technical proposal. However, the consultant is required to follow i) technical investigations/tests and consultative process with the local stakeholders to identify geo-hydrological problems and environmental constraints with regards to source of water; ii) technical test/investigation to identify design and operation related problems of existing technological options; and iii) technical and demonstrative process for innovating context based improved design/ technological options for Climate resilient water supply in the above climate risk 13 coastal districts to carry out the assignment.

4. Team Composition & Qualification Requirements for the Key Experts

Key Experts competencies:

The team undertaking the feasibility study is comprised of professionals having relevant experience and expertise for carrying out the above assignment with their clear inputs.

Summary of the minimum requirements of the team

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Key Experts:

Consultants						
Sl No	Key Experts	Person	Total Man-Month	Qualification	Experience	Task
1.	Team Leader (Water Supply Engineer)	1	36	Minimum of Master's degree in Civil Engineering/ Water Resources Engineering/ Hydro-informatics.	He/She should have at least 15 years experience in water resources/urban water supply planning management. Previous experience in water supply project development, management and implementation. Preparation of master plan will be preferred. He/She should have experience in at least 01 similar projects in the position of TL or DTL. Minimum 10 years experience in the use of network modeling and hydraulics particularly experience in design of water distribution systems using standard software like EPANET or Water Gems or InfoWater. Particular experience in design of water distribution system.	<ul style="list-style-type: none"> • Full responsibility for all aspects of planning, liaison and reporting; • Provide advice and direction to the technical groups and specially lead the modelling and design study team; • Suggest and formulate option scenarios for the study; • Identify the most suitable location for the plant and intake; • Plan and assist in designing treatment plant, it's components, raw water and clean water transmission line; • Assess present demand calculation and future demand projection analyze the data using computer based program, prepare the hydraulic design of pipe network. • Guide in preparing the drawing and specification of pipe network • Prepare project plan, schedules and time frame work for the publications of reports; • Attend meetings as and when required; • Identify the most suitable location for the plant and intake; • Plan and assist in designing treatment plant, it's components, raw water and clean water transmission line; • Assess present demand calculation and future demand projection analyze the data using computer based program, prepare the hydraulic design of pipe network. • Guide in preparing the drawing and specification of pipe network • Responsible for quality control of output of the study; • Contribute and review the reports and give suggestions for improvement.
2..	GW and surface water Modeller	1	36	Minimum of Master's in civil Engg./ Water resource Engg./ Hydro informatics.	He/She should 12 years experience in groundwater modeling and surface water groundwater interactions.	<ul style="list-style-type: none"> • Development of groundwater & surface water models. • Analyses and interpretation of groundwater aquifer regimes of the study area. • Assessment of ground water resources using groundwater models. • Analyses and interpretation of SW/GW utilizations. • Collect all Surface and Ground water related data. • Assess present demand calculation and future demand projection. • Analyze the data using computer based program, prepare the hydraulic design of pipe network. • Responsible for quality control of output

						of the study. Contribute and review the reports and give suggestions for improvement.
3..	Water Treatment Specialist	1	16	Minimum of Masters degree in Civil Engineering/ Water Resources Engineering/ Environmental Engineering or similar	He/She should have at least 12 years working experience in relevant field.	<ul style="list-style-type: none"> Identify and select the location and type of treatment which is suitable for the location; Outline design of the treatment plant.
4.	Civil / Structural Engineer	1	12	Minimum M.Sc. Civil Engineering degree	Minimum 10 years working experience in design of hydraulic structures including WS infrastructure. Higher degree and experience in relevant field will be preferred.	<ul style="list-style-type: none"> Outline design of various types of structures related to the proposed water supply and sanitation improvements and associated infrastructures.
5.	Electro-mechanical Engineer	1	12	Minimum of Bachelor degree in Electrical/ Mechanical Engineering or similar.	He/She should have at least 10 years working experience in electro-mechanical field specially planning, design, operation and maintenance of electro-mechanical plant.	<ul style="list-style-type: none"> Analyses, Interpreting and Assessment of different electro-mechanical equipment and machinery required for the project; Investigate different options for power supply; Selection of proper power saving electro-mechanical equipment.
6.	GIS Specialist	2	64	Minimum of Masters degree on Civil Engg/Water Resources Engg / Urban and Rural Planning / Hydrology or Masters degree in Geography	Minimum 10 years experience in working with GIS. He/She should have adequate experience in pre and post processing of data required for model application and result interpretation.	<ul style="list-style-type: none"> Prepare ArcGIS based geo-referenced maps of the project area. • Prepares maps of water supply improvement projects. Prepare maps and presentation materials for reporting and discussion meeting; Prepare Pipe network Map & details.
7.	Hydrogeologist	2	60	Minimum of Master's degree in geology, hydrology, engineering geology, physical, or earth science, diploma in civil eng. or in the related field.	He/She should have at least 10 years working experience in water resources development projects. Adequate experience in designing ground water wells	<ul style="list-style-type: none"> Conduct hydro geological investigation; Determine characteristics of the aquifer system; Examine performance of existing operational PTWs, Provide guidance for aquifer testing and drilling new wells.

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8.	Survey Specialist	1	18	Minimum of B.Sc. in Civil Engineering/Water Resources Engineering/Hydrology. M Sc. Engineering is preferred	He/she should have at least 10 years of working experience in related projects. Should have at least 5 years experience in organizing field survey, data collection and processing using the modern satellite based survey equipment. He/She should have adequate experience in supporting mathematical modelling team.	<ul style="list-style-type: none"> • Supervision and quality control of the field survey and data collection activities. • Guide and monitor the preparation / production of drawings, maps and reports. • Interaction with local officials in the matters of survey and data collection specification and quality control. • Contribute in reporting.
9.	Sociologist	1	14	Minimum of Masters degree in related discipline	Minimum 10 years working experience in the relevant discipline. Higher degree and experience in relevant field will be preferred.	<ul style="list-style-type: none"> • Design and plan needs assessment and ISA surveys of communities in the project area. • To identify future probable social negative impacts of the project and social imbalance. • Arrange interaction meeting with different stakeholders; • Responsible for preparing SIA report • Contribute in the reporting.
10	Environmental Specialist	1	14	Minimum of Masters degree in Civil Engineering/ Water Resources/ Environmental Engineering/ Environmental Science.	He/She should have at least 10 years experience in water resources management, EIA studies, Environmental Management. Previous experience in coordinating water resources assessment and management studies will be preferred.	<ul style="list-style-type: none"> • Conduct environmental study and prepare IEE; • Indicate whether potentially adverse environmental effects are significant or whether mitigation measures can be adopted to reduce or eliminate these adverse effects. • Provide recommendations on proposed project sites, resource demand, waste production and regulation, policies and guidelines for implementation. Responsible for preparing SIA report.
11	Economist	1	14	Minimum of Master degree in Finance/Accounting	Minimum 10 years working experience in financial analyses and evaluation of different option plans including experience in water resources and environment related discipline.	<ul style="list-style-type: none"> • Identify all costs and benefits of different option plans; • Collect all related information for carrying out economical and financial analyses. • Carry out economical and financial analyses for the proposed investment. • Conduct necessary socio-economic survey;
12	Junior Engineer	4	144	He/She should have at least 3 years' experience	B.Sc in Civil engineering	<ul style="list-style-type: none"> • Assist Team leader and senior Consultants. • Interaction with local officials in the matters of survey and data collection specification and quality control. • Assist for preparation / production of drawings, maps and reports.

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Non-Key Staffs:

Non-Key Staffs	Person	Man-Month	Experience	Qualification
AutoCAD / Computer Operator	2	72	3 years	Minimum Bachelor Degree
Office Assistant	1	36	5 years	Minimum Bachelor Degree
MLSS	2	72	3 years	Minimum S.S.C Pass

5. Reporting Requirements and Time Schedule for Deliverables

Sl. No.	Types of report	Result to be incorporated	Estimated weight against total assignment
1.	Inception report	Detailing the methodology, operational plan and implementation milestones within 4 months after signing the contract.	10% of contract value
2.	Draft mapping survey report	District wise draft mapping survey report on contextual analysis with regards to climate change impact on the existing water sources, design and operational constraints of the existing technological options for water supply and technical investigations for alternative/ improved solutions for water source and water supply technologies within 12 months after signing the contract.	15% of contract value
3.	Draft feasibility report	District wise draft feasibility report on alternative/ improved solutions/ technological options for water supply in different geographical contexts with detail technical design and cost estimate and operational and financial sustainability of each improved options within 18 months after signing the contract.	15% of contract value
4.	validation workshop	Conducting national level workshop to disseminate 'District wise final mapping survey and feasibility reports' to the sector experts and national stakeholders for having comments and recommendations within 24 months after signing the contract.	10% of contract value
5.	EIA/SIA Report	Final EIA/SIA for Project area within 28 months after Signing the Contract.	10% of contract value
6.	Technical Drawing and Estimate	District wise detail technical design and cost estimate and operational and financial sustainability of each improved options within 30 months after signing the contract.	15% of contract value
7.	BID Documents	BID Documents for each Package within 32 months after signing the contract	10% of contract value
8.	Submission of final Report	Incorporating all of the comments, recommendation of the sector experts and national stakeholders, the draft will be finalized within 36 months after signing the contract	15% of contract value

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6. Client's Input and Counterpart Personnel

(a) DPHE will provide all available information and project related documents to the Consultant. The head office based Project Management Unit (PMU) and District based Office of the Executive Engineers will provide all necessary TA and supervisory support to the Consultant. However to get support from DPHE, the consultants will be responsible for:

- Organizing regular meetings with the DPHE professional staff to discuss technical and project management issues. Any unresolved technical issues or otherwise should be taken up with Project Director of the project for his intervention and support; and
- Carry out the services as detailed in the "Scope of Work" in the best interest of DPHE for the successful realization of the project with reasonable care, skill and diligence with sound technical, administrative and financial practices and shall be responsible to the DPHE for discharging of responsibilities in a professional and quality manner;
- Organizing at least one validation workshop/seminar at national level and two for zonal level in consultation with DPHE.
- Travel Cost, Survey, Software, Report production, necessary office equipment & furniture cost will be reimbursable. Team Leader will be work in PMU Office, Dhaka. Consultants will be posted in Khulna & Barishal District as per field requirements. GW and surface water Modeller will act as a Deputy Team Leader and must be posted Khulna office. After completion of the project all documents, Software, Database, Maps, Drawings, Computer and office equipment will be handed over to PMU office, Dhaka DPHE before final Payment.
- Tax, VAT, will be deducted at source from the payment as per the rules of Government of Bangladesh.

(b) Professional and support counterpart personnel to be assigned by the Client to the Consultant's team.

7. Selection Method and Criteria

The consultant-Firm should have the following experience:

At least 15 years of experience in feasibility studies, demand surveys, financial economic technical social and environment assessments preferably with WASH sector. The firm should also have experience of implementation, knowledge and understanding of the operation of water and sanitation, variable success in the delivery of high quality outputs within time and budget constraints.

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The criteria for selecting firm will be:

1. Firm history, especially the age of the firm
2. The firm must have experience in managing/providing implementation support of similar type of project especially feasibility study & Construct different type of Water Supply Options or similar infrastructure (preferably in WASH).
3. Experience in planning and designing of similar type of infrastructures for Coastal Area Water supply systems and experience in institutional development activities.
4. Adequate experience in technical, project management and institutional capacity building support at decentralized level
5. Financial health of the firm
6. Experience in Development Partner funded projects.

The Consultant will be hired and contracted as per the "Quality cum Cost based Selection (QCBS)" method under the World Bank 'Procurement Regulations for IPF Borrowers (July 2016, Revised November 2020)'.

Naziam Tasmin
24/11/2021

(Nazia Tasmin)

Executive Engineer, Training Division
Department of Public Health Engineering, Dhaka
&
Member Secretary, ToR Approval Committee, DPHE

Dalila
24.11.2021

(Dalila Afroze)

Executive Engineer, Design Division
Department of Public Health Engineering, Dhaka
&
Member, ToR Approval Committee, DPHE

Atimbar
24.11.21

(A. H. M. Khalequr Rahman)

Executive Engineer, R&D Division
Department of Public Health Engineering, Dhaka
&
Member, ToR Approval Committee, DPHE

Eusuf
24/11/2021

(Mohammed Anwar Eusuf)

Superintending Engineer, Planning Circle
Department of Public Health Engineering, Dhaka
&
Member, ToR Approval Committee, DPHE

Md. Sarwar Rahman
28.11.2021

Superintending Engineer, Ground Water Circle
Department of Public Health Engineering, Dhaka
&

Member, ToR Approval Committee, DPHE

Md. Sarwar Hossain
28/11/21

(Md. Sarwar Hossain)

Adtl. Chief Engineer (Works)
Department of Public Health Engineering, Dhaka
&

Convener, ToR Approval Committee, DPHE

CE, DPHE

Proposed TOR may be approved.

Sb.
24/11/21

শান্তনু বড়ুয়া
সহকারী প্রকৌশলী
জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
প্রধান প্রকৌশলীর কার্যালয়, ঢাকা।

Approved TOR.

Sb.

মোঃ সাইফুর রহমান

প্রধান প্রকৌশলী

জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
বাংলাদেশ সরকার, ঢাকা।