



## **Nangarhar Province Water Supply Network Design Package**

**Project: 'Provision of integrated emergency primary health care, nutrition, protection, and WASH services for conflict and disaster-affected people in Afghanistan's Eastern and Northern regions**

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**Donor : USAID/BHA**

**Implementing Partner : International Medical Corps**

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## TECHNICAL SPECIFICATION STANDARD FORMAT FOR WATER SUPPLY PIPE SCHEME EQUIPPED WITH SOLAR SYSTEM

### Jangzai Village, Sherzad District of Nangarhar Province

#### **1. PURPOSE**

The document is intended to highlight the WASH interventions, International Medical Corps (IMC) is planning to implement through the funding of **USAID / BHA** Afghanistan. The project deliverables are to improve access to water in Jangzai Village, Sherzad district of Nangarhar Province. The WASH interventions will reach 320 families with improved WASH coverage.

The details are provided below:

#### **2. DESCRIPTION OF THE ACTIVITIES:**

This is a brief description of the scope of works. The technical specification required will be described below and the designs are in Appendix.

- **Drilling of Borehole**, as per agreed design and drawings provided. The average depth would be limited to **100-120m** with a minimum of **30-40 meters of the water column** in the borehole to consider a productive/successful borehole.
- Construction of **20 m<sup>3</sup> Elevated Water tank** along with the installation of **1 Gate valve box**.
- Installation of **Solar water pump System** (solar panel and pump) with all its necessary accessories.
- Installation and construction of **water distribution network** as per the agreed drawing and design.
- Construction of Surrounding wall around(fence) the borehole, Solar panel /PV system as per agreed drawing and design.

#### **3. LOCATION AND ACCESSIBILITY:**

The Solar water supply network system site is located in Jangzai Village, Sherzad district of Nangarhar province. IMC team, in collaboration with the Sherzad district- Jangzai Village Water Management Committee (WMC), will mark the exact locations of the water supply network system site. IMC will successfully hand over the site works to the contractor to initiate the agreed scope of works defined for the construction work Borehole through a joint IMC (program and support) teams and community field visit.

#### **4. MOBILIZATION**

The work shall consist of mobilizing equipment, supplies, and securing bonds and permits necessary to do the work as stated in the contract and/or agreement and demobilizing excess materials and equipment from the worksite.

#### **5. SUPERVISION AND MONITORING**

IMC will designate one of its staff to coordinate with the contractor to regularly monitor the drilling of borehole, construction process, and installation of items. IMC will undertake on-the-spot checks and monitoring of the progress and quality of the work. The contractor must inform IMC of the project's milestones so that IMC monitors the above-mentioned activities together with the contractor.

The contractor will always collaborate with the IMC field supervisor to be guided by the technical specification, and the scope of works to be carried out.

## **6. PRE-AMBLE TO THE SPECIFICATION**

This specification covers the *minimum standards of workmanship and materials* required by the Contract. All works shall be carried out with the approval of the *IMC WASH Engineer*. Any civil works or materials that do not meet this specification's requirements shall be *repaired or demolished and re-instated* at the *Contractor's expense*. The Contractor shall be liable for any delays to the project caused by construction or demolishing defective work.

Any items of work not described in this specification but forming part of the works shall meet the minimum standards of workmanship and materials. The civil works or materials *need to be approved* by the IMC WASH Engineer. Where there is a conflict between local standards and this specification, this specification shall take precedence.

This document forms part of the Contract, and should be read in conjunction with the other Contract Documents:

- Contract Agreement
- Conditions of Contract
- Bid Form
- Contract Drawings
- Other documents referred to any of the contract documents.
- Work plan and construction tracker

## **7. MINIMUM STANDARDS FOR WORKMANSHIP AND MATERIALS**

### **Quality of Materials**

The qualities of all construction materials are to be following the State Standards. The IMC WASH Engineer shall check the quality of all materials delivered to the site and put his finding on the Engineers site Note Book once a week. Any materials, which do not meet the minimum standards, *shall be rejected*. Such materials shall be removed from the site and replaced at the Contractors expense with materials of the required quality.

### **Quantity of Materials**

The IMC WASH Engineer shall check that the required *quantity of materials* has been delivered to the site according to the BoQ put the inputs in the project site note book and use them in the works. The IMC WASH Engineer will not certify payment for any materials, which have been specified in the Contract but have not been used in the works for whatever reason.

### **Quality of Workmanship**

The IMC WASH Engineer shall be responsible for checking that the *quality of workmanship* by the Contractor is of an acceptable standard according to this specification. The IMC WASH Engineer will reject any works, which have not been executed to the required standard. The Contractor shall redo any rejected works at his own expense and no time delays to the overall scheme.

## Sand

Sand shall be clean and free from contaminants such as oil, silt, soil, wood, metal, or vegetable. Very fine or smooth Sand shall not be used. Coarse Sand (used for concrete) shall have a maximum size of **5mm**. Medium Sand (used for mortar) shall have a maximum size of 2mm. Fine Sand (used for plaster) shall have a maximum size of 1mm.

## Aggregate

The coarse aggregate used for the concrete mix shall be angular crushed rock varying from **5mm to 20mm for Grade 1 Concrete**. It shall be clean and free from contaminants such as oil, silt, soil, wood, metal, or vegetations. Suppose this type of aggregate is not available. In that case, the CONTRACTOR/SUPPLIER must seek the IMC WASH Engineer's approval in the Journal book on which other types to use.

## Cement

Cement (**Portland 400 or 500**) shall be delivered to the site in prime powder form and sealed bags. It shall be kept clean and dry until usage. Partially used bags of cement shall be stored in a dry place until required. Any partially used bags, which have become damp, shall be rejected. The Contractor will store the empty bags for the IMC WASH Engineer's count and dispose of them by the Contractor.

## Bricks

Shall be obtained from an approved source and of uniform color, size (7\*11\*22) cm, and shape. Bricks shall have smooth rectangular faces with sharp straight, right-angle edges. Maximum absorption shall not be more than 20% of its dry weight on immersion in water for **24 hours**. Minimum crushing strength shall be **75 kg/cm<sup>2</sup>**.

## Water

Water used for concrete mix, mortar, plaster, and other construction materials shall be potable, clean, and free from organic material. If none is available on site, the Contractor shall transport suitable water to the site.

## Clay:

The clay must be of industrial quality and delivered in small aggregates, if possible. If not available, the clay used to create the plug should come in chunks of small size (less than 5 cm) to avoid them being stuck in a higher position than they are supposed to.

## Gravel pack:

The gravel to use as a filtering layer must be between 3 and 5 mm. They must be washed and clean.

## Rotary drilling

- The capacity of the drilling machine (Rotary) must be at least 120meters in depth. The machines must be able to drill on a diameter of 12" (depending on the soil's nature).
- The contractor to keep a log of the well drilling and present the data to the IMC WASH engineer for approval for selected casing pipes (blinds and strains); during the perforation, the cuttings will be taken at each change of ground, or every two meters drilled as a maximum. The samples taken at the borehole outlet will be placed in a sample box with different compartments to visualize the geological section. After the drilling operation, the samples will be kept in plastic bags at the building site, IMC staff will provide a borehole log. The materials will be at the disposal of the IMC WASH Engineer, which will decide on their conservation or not.
- A borehole log report will be written and submitted to IMC as a draft.

## Contractor's Drilling Equipment

- The Contractor shall specify in the Schedule of Drilling Equipment, borehole development, and other accessory equipment the type, and capacity that is to be used to undertake this work. Its capacity shall be sufficient to cope with the Works as stated in the Contract. And It shall at all times be kept in complete working order and good repair.
- If the Client considers that the drilling equipment or any accessories in use on the site of the Works is in any way unsuitable, inefficient, or inadequate incapacity, the Client shall have the right to call upon the Contractor to put such equipment in good order within seven days or to remove such plant and replace it with other plant or equipment which the Client considers necessary to meet the requirements of the Contract. If this requirement of the Contract is not satisfied, the Client reserves the right to terminate the Contract immediately
- No extra payment shall be made for the Contractor's change of drilling equipment, labor, or other equipment required to complete the Works specified, nor for any incidentals to that, the cost is deemed to be included in the schedule of rates.

## Well Development

- The drilling machine (Rotary) must have the capacity to drill diameter of 12" and a minimum depth of 120m.
- PVC Casing 8" class D is considered as per the agreed design.
- PVC Filter 8" Class D is considered as per the agreed design.
- Small gravel 3-6mm for backfilling/gravel packing around casing is considered.
- A flexible steel cable with a diameter of 16mm for casing stability is considered.
- Installation of Solar pump European-made technology according to attached standard drawing and specification.
- Well-cleaning by compressor machine, Pump tests for 8 hours, and chemical, and biological tests are considered after drilling the well.
- Superficial sedimentary formations drilled with the cable-and-tools machine with mud up to more than 40m of depth on average.
- First development test for a minimum of 8 hours.
- Second development of the Boreholes for a minimum of 8 hours.

## Borehole design

The final design of the borehole shall be confirmed by the Supervisor in consultation with the Contractor during the drilling process, or immediately after drilling is completed.

Grout is to be injected into the annulus using hopper pipes, or a method approved by the Supervisor, in a continuous operation to achieve a complete and continuous seal.

## Borehole Equipment

On completion of drilling, the Contractor must choose a suitable and appropriate borehole development method. The borehole shall be developed for at least ten hours to obtain a maximum water yield free of suspended matter. Developing shall be carried out by airlift pumping and surging, jetting and block surging, or other techniques the contractor feels are more appropriate and efficient to suit the casing, hydro-geological, and drilling conditions prevailing in that borehole. All boreholes shall be presented for testing free of any bridging or obstruction to the total depth. The developement will be for a minimum period of 8 hours, and the minimum yield should be 1.5L/s.

## Water Quality testing:

- The contractor should, make sampling and quality analysis of water from every borehole.
- The water quality tests must be conducted at a competent testing laboratory IMC authorizes.
- The tested parameters are given in the table below, Standards will be according to WHO guidelines for drinking water quality.
- Water samples for chemical analysis should be collected at the end of the test pumping process and analyzed at the approved laboratory at the earliest possible time to facilitate timely handing over the borehole for use by the community. Thus, the Strategic borehole should only be fitted after acceptable chemical analysis results. Samples for biological testing should be collected later in suitable batches to meet the time limit of 48 hours between collecting and analysis in the laboratory.

**Table 1:** showing Parameters to be tested:

Biological	Physical	Chemical
Coli forms	Turbidity	Fluoride
	Color	PH Value
		Total Hardness
		Total Dissolved Solids
		Nitrates

## Installation of Solar Powered Pump

The Contractor shall provide all power and control wiring necessary to operate, control, and connect all components of the solar water system. Wire size for each component shall conform to the existing wiring of the current system. However, suppose the existing wiring system is damaged due to the wind. In that case, IMC shall provide the contractor with the exact specifications of wires and equipment used on the system.

The size and type of products are below:

- Pump, inverter and etc. made in standard European product according to attached drawing+ design data and its specifications. Submersible pump system including a controller with Data Module, motor, and pump end.
- Solar Panels: European standard quality 36 pc. 18\*2 modules; 33 titled, according to attached designed parameters and BoQ discriptions.
- Motor cable: 100 Meters, 16 mm2 3- phase cable for power, and 1- phase cable for ground (Turkish Made).

IMC designed and sized the solar pump system by Lorentz compass application, if the vendors are seeking for other European products available in Afghanistan, the vendor should submit the complete design along with products guarantee and solar company fact sheet.

The contractor shall provide all material to ground the system if the system is not already grounded. The contractor shall provide a ground sized to AWG 6 (16mm) bare ground with one piece 8' ground rod (solar negative must be grounded to the earth).

The contractor shall ensure that all exposed wire run on walls shall be run and installed in surface-mounted trunking conduits in an orderly, level, and plumb manner. Visible surface-mounted wires shall not be allowed. The Contractor MUST cut, patch, and paint all surfaces damaged or altered during the installation of the solar system

### Installation of Solar System

- RCC foundation for solar pile should be considered as per BOQ.
- According to the attached data, the solar Inverter and pump are of European standard quality.
- Installation 30x30\*12mm metallic disc for the stability of solar pile on the surface of the foundation.
- 36 Solar panels.
- Metallic Frame for placing solar panels please refer to design Drawing and BOQ for more details.

### Excavations

Excavations shall be clean and free of water. The IMC WASH Engineer shall inspect all excavations before work proceeds. The Contractor shall give the IMC WASH Engineer 5 days notice of the inspection date.

Excavations are dangerous and liable to collapse, particularly in wet weather or waterlogged ground. The Contractor shall take all necessary precautions to ensure that all excavations are adequately protected to prevent accidental or unauthorized entry. Excavations dept must be according to drawing and design; dept shall not be entered unless they are shored up with wooden or another temporary bracing. The Contractor shall be responsible for safety, and be liable for any accidents, which may occur.

### Concrete

Except otherwise specified, all plain and reinforced concrete works and concrete in general (either hand or machine mix at site) will meet the applicable standards & specifications.

### Concrete design mix:

The materials used in concrete shall be proportionate by weight following the standard cement/sand/aggregate mix ratios as follows:

- For reinforced concrete mix - 1:1.5:3 mix ratio only for footing and columns
- For reinforced concrete mix - 1:1.5:3 mix ratio for beams, slab, and peaks.
- For plain/mass concrete mix - 1:1.5:3 mix ratio
- For brick masonry mortar mix- 1:6 Mix ratio
- For plastering mortar mix- 1:3 Mix ratio
- For stone masonry mortar mix- 1:5 Mix ratio

The aggregates mix, cement, and water content ratio shall be selected to obtain the best results for compressive strength, density, water tightness & durability, workability, and finish quality. The concrete mix must be such that the design is compatible with the minimum water content ratio to give each grade adequate concrete workability.

The grades of concrete for the various works shall be as noted on the drawings and as below:

C25: all reinforced concrete (foundations, slabs, etc.)

- Characteristics compressive strength at 28days: 250kg/cm
- Minimum cement content: 280 kg/m
- Max free water content ratio: 0.40
- Max nominal size of aggregates: 25mm

After placement, the concrete shall be vibrated by mechanical means. The vibration method is to be approved by the WASH Site Engineer/works personnel before the operation. The vibrated and consolidated concrete is finished by toweling or floating the surface to a smooth and flat finish.

Following placement, vibration, and finishing work to the concrete and after the initial set has occurred not to damage the concrete surface, appropriate measures, approved by the site Engineer/Works personnel are to be implemented to cure the concrete for a minimum period of 14 days.

Where concrete previously placed as part of the works is to be butted, jointed, or raised with the addition of further concrete, except in the case where the initial concrete is blinding concrete, the first concrete surface must be suitably prepared by the scrabbling, i.e., removing the laitance (fine concrete surfacing) before placement of the other concrete. The method is to be approved by the Site Engineer/Works personnel. After scrabbling, the concrete shall be a thoroughly wetted and thin layer of 1:2 cement: sand mortar applied before pouring the new concrete.

Steel reinforcement shall be positioned with a clearance of 40mm to the face of the concrete unless otherwise directed by the IMC WASH Engineer/Works personnel or shown in the Contract drawings.

Formwork for the concrete shall be to the approval of the IMC Site Engineer and shall not allow grout loss from the concrete mix.

Prior to the concrete placement, the formwork is to be inspected and all harmful materials removed to the approval of the IMC WASH Engineer/Works personnel.

The Contractor must undertake no mixing or placement of concrete without prior permission by the IMC WASH Engineer.

## **Reinforcement**

Steel reinforcement shall be 60 grade with the correct diameter, as shown on the drawings. The bars shall be clean and free from rust. And be securely fixed with wire before placing the concrete. The minimum cover to reinforcement shall be 25mm.

## **Framework:**

The exact dimensions and positions shall be as per the issued execution drawing. All formworks shall be designed and built to maintain rigidity throughout the concrete placement, ramming, vibration, and setting to the required shape, position, level, and specified class of finish. All joints shall be sufficiently tight to prevent leakage of concrete.

Before concreting commences, the formwork shall be thoroughly cleaned and freed from all sawdust, tie wire, shavings, earth, dirt, and other debris. Release agents should be applied and compatible with the finish class; care must be taken not to contaminate the reinforcement.

Striking of formwork shall be done without damage to the concrete, including removal without shock to prevent impact load on the partially hardened concrete. For columns, walls, and other parts not supporting, the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist possible damage due to removal operations. For suspended slabs or supporting formworks, 14 days of hardening are required before striking forms.



## Placing Concrete

Once mixed, concrete shall be used immediately. Any concrete, which had been allowed to achieve its initial set, shall not be placed. Concrete shall be placed in layers with a **maximum thickness of 250mm**. Each layer shall be thoroughly compacted with a wooden (or any other) rammer. When placing on old or set concrete, the surface of the old concrete shall be thoroughly cleaned and wetted with water. The surface must be chipped to form a suitable key if the surface is smooth. Old concrete shall be painted with liquid cement prior to placing new concrete.

## Curing Concrete

Sufficient water is required for concrete to harden through hydration. The concrete must be kept moist or "cured" to ensure it does not dry out. Poorly cured concrete will shrink or crack, and not achieve its full strength. Concrete shall be cured by covering it in plastic sheets.

Spraying with water, covering with wet Sand, or other methods proposed by the Contractor and approved by the Engineer. The Contractor shall ensure that all concrete is adequately cured. Curing shall start as soon as the concrete has been poured and shall continue until curing is complete **after 28 days**.

## Concrete Finishing

Concrete shall be finished to a smooth uniform surface and finished using a metal or wooden float. The surface texture shall be flat and smooth with no irregularities or air bubbles. When formwork is removed, the face of the concrete shall be flat and smooth. If there are signs of voids, air bubbles, or inadequate compaction, the concrete shall be removed, disposed of, and re-laid with a fresh mix.

## Stone Masonry

Stone must be granite, and Stone shall be of uniform size and shape and the specified dimensions. The Contractor may substitute alternative-sized Stone with the prior approval of the IMC WASH Engineer and at no additional expense.

Walls shall be straight, perpendicular, and dimensionally correct, constructed as shown on the drawings (if included). The lines of mortar shall be horizontal with no excess mortar staining the faces of the walls. The faces of walls shall be regular and even, with no irregular stones.

## Mortar

Mortar for stone and brick masonry shall be mixed in the proportion of 1 cement: 4Medium Sand by volume. Sufficient water shall be added to achieve the desired workability. The surfaces of the stones must be smooth and have a medium size; the mortar shall be placed on all horizontal and vertical faces between the Stone, with no gaps. Each Stone shall be placed to the correct line and level and shall be level in all directions. Any gaps shall be filled with additional mortar rammed in with a small wooden rammer. The outside faces of stone walls shall be pointed. No excess mortar shall be allowed to stain the faces of the Stone.

## Brick masonry in Cement Mortar

The bricks shall be first-class, regular in shape, size, and color, **free from flaws, cracks, lumps**, and minimum crushing **strength of 75kg/cm<sup>2</sup>**. Maximum absorption shall not be more than 20% of its dry weight on immersion in water for 24 hours. The Sand used shall be medium coarse, clean, sharp, and free from clay, mica, and other organic matter. The cement used shall satisfy the requirement of the common Standard; the Mortar is designated in the specified proportion of cement and Sand. The materials are weighed or

measured and mixed on a watertight platform after allowing the bulk age of Sand. Bricks before laying shall be thoroughly soaked in water, and the brickwork shall be kept wet for at least 10 days.

## Plumbing work

The contractor shall ensure that all pipes and fitting comply with the requirements of IMC design and drawing and except those of a minor nature shall be carried out by a designated person, the service shall not run through individual premises, beside this, plumbing installation shall be arranged to avoid water contamination, water quality deterioration, water leakage and to ensure proper environmental consideration during installation of pipe network materials. **The plumbing equipment is required to be certified by the IMC site engineer.**

## Plaster and Pointing

Plaster and pointing for internal walls and external rendering shall be mixed in the proportion of 1 cement: 4 for plaster and 1 cement:3 for Pointing Fine Sand by volume. Sufficient water shall be added to achieve the desired workability.

The walls shall be wetted before applying the plaster and pointing. The plaster shall be 10mm to 20mm thick and pointing according to the stone construction state. It shall have a uniform flat finish free of irregularities and blemishes. The finish shall be clean and precise at corners and between walls and ceilings in a straight line. Untidy or poorly finished plaster shall be rejected.

When the plaster is still damp, the wall shall be floated to a smooth finish with a wet steel float.

## Painting

The outer side shall be used, weather **sheet paint 75%** and the inner side shall be used plastic color **75% two times**. For stone, masonry shall be used oil paint two times IMC as per site engineer coordination.

## Drainage System

Used and surface rain runoff water: All water from the Facility must be collected and channeled through the **drainage channel into soakaway pits**. The water drained from the high risk shall be channeled to the high-risk **soakaway pit**, while the water drained from the low risk shall be channeled to the low-risk soak away pit.

All water from the Facility, including water from hand washing basins and surface rainwater, must be collected and channeled through man-holes into a soakaway pit as per site need.

## Pipe Network Construction and Installation

- Different sizes of polyethylene pipes (china, Pakistani, and Afghanistan) are to be considered for the network as per the agreed drawing provided.
- Cross drainage structure should be considering to cross the pipe against any possible obstacles.
- 20 taps are considered; for more details, please refer to design and BOQ.

**Note:** For additional details and information not listed above, please refer to design and BOQs.

## Site Cleaning

After completing the work, the contractor must remove all remaining sand, gravels, and cuttings from the site. They must also remove all rubbish leftover from the workers and remove the drilling machines.

### **8. WORK FOLLOW-UP**

To allow an adequate work follow-up, the Contractor will maintain a construction log book at all sites in which all information related to the work will be reported. This book will allow the IMC Engineer to know precisely the progress report of drilling work as of his arrival on the construction site. The remarks and reserves of the Contractor and/or the person in charge of the program will be notified in the book of the building site. A copy of this field notebook will have to be given to IMC at the end of the project. It might be used as an intermediate or final report to the donor. Information to be recorded in the construction site log book shall include but not limited to:

- Name of the building site (number of the borehole with the location description ).
- Borehole log description of the samples (cf. cuttings/m).
- For each drilling, date and hour of arrival, starting and finishing of the drill.
- Everyday Hour of installation and hour of the beginning of drilling.
- Time of drilling measures per meter.
- Diameter and technique used meter per meter.
- Rate of the advance of the tool for drilling.
- Depth reached by each stem.
- Nature of the crossed grounds "cut sounder."
- A sketch with the composition of the drilling equipment: length of full tubes, screened tubes, the volume of gravel, height of cementing, etc.
- Duration, yield, the limpidity of water, and various water levels at the time of the operations of development and flow.
- Generally, all technical details, incidental, clean breakdowns, difficulties with the course of work, with an indication of the hours when they occurred.

### **Safety:**

The contractor should provide sufficient safety measures for skilled and unskilled labors and other hired workers on the Project site, the contractor should also provide workers and laborers with all required PPEs (personal protection equipment).

