
Terms of Reference (ToR)

Supply and Installation of Solar Water Pump and related works

Project: Lighting rural school through Direct Current Electrification

PN: 14.2275.7-836.00

1. Background

Energising Development (EnDev) is an energy access partnership currently financed by six donor countries: the Netherlands, Germany, Norway, the United Kingdom, Switzerland, Sweden and Ireland and EU at country level. EnDev promotes sustainable access to modern energy services that meet the needs of the poor - long lasting, affordable, and appreciated by users.

EnDev has taken a lead role at promoting access to Sustainable Energy for All. The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) cooperates closely with the Netherlands Enterprise Agency (RVO) at the global level.

As part of the EnDev Ethiopia project, GIZ has signed a letter of agreement with the Norwegian Embassy to electrify rural schools with solar PV power in Amhara and Oromia Regional States.

An adequate understanding of the vision and context that determines the requirements of schools is formed through meaningful discussion with the local partners. Primarily, this entailed a close cooperation and dialogue with the Ethiopian Ministry of Education, which suggested the equipment that should be provided to the schools. These requirements set out a clear demand, which the selected technology has to meet. Besides, the dialogue spanned further and included local institutions and governmental offices the district level.

The project is expected to electrify 33 schools with PV power supply, where two of the selected schools get access to water with additional solar water pumps.

The base case includes only minimal additional appliances. In the second case, the school will be equipped with a laptop and projector. In the third case, the school is equipped with a TV and satellite receiver, instead of the laptop and projector. For the secondary schools, a system that will serve all the appliances is proposed.

EnDev is looking for qualified solar water pumping system suppliers for the design, delivery and installation of complete sets of solar water pumps for selected schools in Amhara and Oromia regions.

Suppliers are expected to carefully examine and comply with all instructions, contract provisions and specifications contained in this term of reference. Failure to submit a document containing all the required information's and documentation within the deadline specified shall result in rejection from the bid.

The bidders are:

- i. Requested to provide all the general information as requested,
- ii. Incorrect information in any respect will render the bid ineligible,
- iii. Clearly indicate the specifications and test certificate of solar water pumping system,
- iv. The document to be submitted should be spiral-bound, all pages numbered, countersigned and stamped.

Mandatory requirements for Pre-Qualification

1. Company profile
2. Valid registration certificate
3. VAT registration
4. Trade references (such as Tax clearance certificate, PPA registration certificate, certificate of competence for installation Electro-mechanical contractor 5 or above) and letters of recommendation

2. Objective of Work

The objective of this work contract is the provision of power for water pumping (solar PV with all its full accessories) in the existing boreholes in two of the selected schools in Amhara and Oromia regions with a minimum of 5m³/day water supply.

3. Scope of work

In addition to the design, supply and installation of solar PV system, the work includes

- Verify the data presented in this ToR by visiting the site before commencement of the work. The necessary work for site assessment is presented in Annex-I.
- the construction of fencing for the module installation,

- the construction of pump housing as per the drawing (or similar drawings to be submitted by the contractor),
- the supply and installation of pipes from borehole to water tanker,
- the supply and installation of 5m³ water tanker,
- the supply and installation of pipes from tanker to water points,
- the construction of water points.

Refer to Annex-I for work details to be performed and Annex-II through IV for technical descriptions.

4. Place of work

The work will be for two schools located in Amhara and Oromia regions. Site details are presented in Annex-II.

5. Duties and responsibilities of the contractor

- Present all the necessary documentation required by this ToR with the plan and time frame required to conduct the work.
- Verify the data by visiting the sites.
- Prepare and present a report of the findings of the site assessment to EnDev Ethiopia team.
- Present the design of solar water pumps using the data gathered from the site assessment.
- Provide and install the solar water pumps as per the design and recommendation.
- Provide awareness and operator training to school staff and Woreda representatives as per EnDev's recommendation.
- Hand-over complete and functional system to representatives from Woreda education bureau, Woreda/Zone energy bureau and the school. Finally submit a report (soft copy using CD and hard copy) to GIZ EnDev Ethiopia.
- Perform first service visit and maintenance of the system and final hand-over after warranty period (after 6 months).
- If faults and/or damages occur on the materials delivered by the contractor the responsibility is with contractor.

- If installation and/or connection faults occur during the installation, it is the responsibility of the contractor.
- In case of system/ installation problems the contractor is responsible for all corrections under the warranty period.

6. Responsibility of EnDev

- EnDev Ethiopia shall make available all data, documentation and information required by the Contractor for carrying out the works under this agreement.
- Evaluate the site assessment report, the methodology and the design proposed by the contractor and provide feedback within one week of submission of documents by the contractor.
- Supervise and support the contractor in conducting the site assessment and the installation of the solar water pumping system and other related works.

7. Time schedule

- The overall work at the sites together with submission of report shall be completed within 2 months after signing of the contract agreement.

8. Report requirement

All reports should be submitted in electronic on CD and printed & bound hard copies. All reports should be submitted in the English Language.

It is required to provide face-to-face presentations in EnDev Office of the site verification visit as an integral part of the submission process.

- Detailed site plan and recommendation for the position of the water tanker and the water points
- Milestones

9. Remuneration

Payment related issues and contractual agreement shall be concluded according to the prevailing GIZ rules, regulations and guidelines. However, for an unfinished work or a non-functioning system, payment will not be effected.

10. Required qualification and experience

- The company must have a minimum of five years' experience on the field in Ethiopia.
- The company must have contracted a minimum of five similar projects in Ethiopia in the past three years.
- The company is required to clearly provide assigned experts CVs, clearly stating their roles and responsibilities for this particular project.

The proposed expert should include the technical expertise and practical experience required to deliver the scope of work, in particular, with regards to:

- Relevant subject matter knowledge and experience
- Management experience
- Ability to work in a team
- Regional experience: it is particularly important that the expert has the appropriate regional knowledge/experience and language proficiency required to conduct the required work;

The company should provide evidence of previous project experience for the provision of similar supply and installation work required by this ToR.

11. Confidentiality and ownership

- All information and documentation given to the service provider institution is strictly confidential and may be used only for the purposes of completing this assignment. All documentation and illustration material must be returned immediately on completion or termination of the assignment to GIZ-EnDev Ethiopia.

12. Amendments

- This Terms of Reference may be amended in writing only, perhaps subject to the agreement of both parties.

13. Submission of offer

Submitted bids must comply with the requirements in the ToR and comprises;

- **Technical offer:** a detailed description of the solar system components in conformity with the required performance and specifications.

Terms of Reference

- **Financial offer:** contains the details on solar components and installation price.
- **Documentation:** this refers to all relevant and legal documents that includes but not limited to legal licenses, renewed trade license, VAT registration, tax payer identification certificate, etc.

The supplier must comply with the technical specifications set out in the ToR.

Annex – I: Technical specifications

- **Description of Work**

The work comprises the following items:

- a) Mobilization/ demobilization
- b) System planning and design
- c) Site assessment for data verification
- d) Supply and installation of solar water pump
- e) Supply and install a 5m³ fiber glass water tanker together with a metal stand
- f) Construction of pump house
- g) Construction of water point

a) Mobilization/Demobilization

.1 Mobilization/ Demobilization

The Contractor shall transport all equipment and its staff safely as necessary for proper completion of the contract.

Mobilization shall consist of all necessary manpower, installation tools and construction materials to the construction site.

The contractor shall also transport solar PV equipments and related materials to the site.

It is the responsibility of the contractor to supply and transport necessary materials such as water tanker, cement and related materials for water point and well head construction required to accomplish the work.

After completion of the work demobilization shall consist of cleanup work and operations including but not limited to those necessary to the removal of personnel equipment and incidentals from the project site.

.2 Inspection of materials and equipment

The contractor shall present to the supervisor the list of equipment and samples of materials to be used on the project. The contractor is not allowed to start the work on site until the supervisor has checked and approved the equipment and materials.

b) System planning and design

The system must be designed and planned using computer based tools that can closely model the irradiation, power generated from the solar array, ambient temperature, and typical pump performance. Planning and design should be done showing monthly pumped water outputs in line with the water requirements for each site.

- **A full list of equipment offered should be included together with their technical specifications.**
- The array should be tilted with respective latitude degrees of the sites. The module support structure could be manufactured locally where the solar panels to be mounted at a height of at least 1 meter above the ground level. **All the profiles for module support structure should be produced using galvanized steel.**
- The system should be of high quality. The contractor should outline the key design elements that make the solution suitable for the school environment it is going to be installed.

Refer **Annex – II** for site details and well characteristics.

.1 Experience

The potential supplier must have at least 5 years of experience in the design, supply and installation of similar systems or larger as described in this ToR.

.2 Design life

System design should eliminate the use of batteries and solar tracking systems which will shorten the lifetime of the system.

The design life of the system must be 25 years.

Component lives should be a minimum of:

- 20 years for solar generator,
- 7 years for pump motors; 5 years for pump ends; 7 years for control equipments.

All components should be subject to minimal servicing and without expensive parts.

- Civil structures: 30 years
- Civil works-frames: 30 years without major repair
- Mechanical and electrical fittings: 30 years

GIZ EnDev strongly recommends the bidders to visit the site prior to submitting their offer.

Technical information required to be submitted by the supplier

No.	Technical information required	Specification / remark
1	Total daily water capacity of the pump system (m ³ /day) (l/s)	Attach the daily and hourly pumping capacity during operating time (discharge versus head curve, input power versus discharge curve)
2	Total dynamic head the pump can lift (m)	
3	Maximum head lifting capacity of the PV system (m)	
4	Size of submersible pump (inch)	
5	Maximum flow rate of the pump (l/s)	
6	Mean solar irradiance for design month (kWh/m ² /day)	
7	Hydraulic power requirement (watt)	
8	PV array needed (Wp)	
9	Recommended module size (Wp)	
10	Number of modules in series	
11	Number of modules in parallel (strings)	
12	Type of pump, type of submersible motor, volt, phases, power supply and accessories.	

c) Site assessment for data verification

As stated above, GIZ EnDev’s recommendation is for the bidder to visit the site prior to submitting their offer.

The main objective for the site visit is the verification of the data used to design the system. This includes but not specific to,

- Choosing the exact location for the tanker,
- Determining the necessary piping and fittings to be laid from the borehole to the tanker and the tanker to the water point,
- Choosing the location of the water point for drinking,
- Choosing the location of the water point for washing near the latrine,

- Choose the location of the PV modules to be free from children playground, etc.

Although the preliminary design submitted could be used, the design can still be changed if the taken figures greatly differ after verification up on site assessment.

d) Supply and Installation of solar water pump

It is the responsibility of the contractor to deliver all solar goods to the sites for installation. The contractor shall install, test and put in operation all systems. The supplier will be responsible of all equipment including security up to provisional acceptance.

The civil work around the solar generator and pump installation includes:-

- a) the foundation of the support structure for the PV modules,
- b) the construction of pump housing, and
- c) the fence surrounding the PV array and the pump housing using appropriately selected angle iron and mesh wire.

Although the implementation of all installation work is of the responsibility of the contractor, it is recommended to contract the local persons to perform some of the civil work such as the foundation and trenches digging.

The bidders need to clearly present the drawing for the module support structure and the well head construction done using software such as Auto CAD. The bidders also need to clearly present the construction work detail for all.

.1 Support structure for the PV modules

- GIZ EnDev's recommendation is the production of the support structures locally.
- Refer GIZ EnDev's recommendation for the support structure design in Annex – III. The contractors are required to provide their own design that can be viewed from all angles.

.2 Fence surrounding the PV array and other components

- The contractor should build a fence around the solar PV array and the bore hole. The contractor should clearly indicate the type of angle iron and mesh wire to be used for the fence.
- The minimum distance from the array post to the fence should be 1.5 meter to avoid shading throughout the day.

- The distance between angle iron posts should not be more than 1.5m.
- The height for the angle iron (of course including the mesh wire) should be a minimum of 1.5m and shall not bring any shading to the PV array to be installed.
- Entrance door to be padlocked must appropriately be designed to access the solar PV area. The design of the door should be presented along with the drawing that shows the fencing surrounding the PV array.
- Look for Annex – III for more details. The submitted design for the fence surrounding the PV array and borehole should show from all angles.
- The work shall include all related activities.

.3 Standards of the equipments supplied

.3.1 Module quality and installation

PV modules must be approved to IEC/EN 61215 and 61730 or UL 1703 certified and listed. All modules must be of a robust design.

- The design of the module stands must be presented along with the module specification.

The contractor must provide:

- Detailed description and specification of the solar modules
- Detailed and clear drawings of the module stands

.3.2 Protection

The system must have dry run protection to protect the system in the event of low water levels. Other protection systems should at least include Surge Protection Units (SPUs) and over/under voltage protection.

.3.3 Control equipment

Control equipment is any equipment that is used between the solar generator the pump motor. Control equipment includes monitoring, power conversion, MPPT (Maximum Power Point Tracking) sensors and other equipment related to the solar pumping system.

- A minimum length of 1.5m copper rod with all its accessories must be provided and all the PV modules to be grounded.

.3.4 Design

Control equipment must:

- Be separate from the other system components.
- Provide diagnostic indicators to show status,
- Have provision for continuous performance measurement.

.3.5 Control Equipment Quality

The control equipment must meet EN61800-1, EN 61800-3, EN60204-1 or internationally recognized equivalent standards.

.3.6 Accessibility

Control equipment must be positioned at 0.5 to 1.5m from ground level for ease of servicing, adjustment and system health diagnostics.

.3.7 Ease of Servicing

Control equipment must:

- Not be integrated into pumps as this presents service access problems.
- Have simple system health indicators that are user visible for trouble shooting purposes – typically of pump status, pump speed, well dry, tank full information.
- Be easy to service and unit replaceable by a trained person with modest skills.

.3.8 Environmental Protection

Control equipment must be housed in a suitable enclosure of robust design for mechanical and environmental protection to at least IP65 or higher.

.3.9 Warranty

The Contractor should detail as part of the technical proposal, the warranty period and the technical support after installation. It is important as well to indicate the availability of service within the country or at least, in a timely fashion.

e) The supply and installation of 5m³ fiber glass water tanker with the stand

.1 Fiber glass water tanker

- The contractor needs to provide a 5m³ fiber glass water tanker and transport to the installation site.

.2 Metal Stand for the water tanker

- The contractor needs to provide a metal stand for the 5m³ water tanker.
- The minimum tanker height from the ground should be 4m.
- The contractor needs to provide Auto CAD design with full specification for it.
- The contractor is responsible for the transportation of the stand to the site.

.3 Installation of the water tanker

- The metal stand must be installed using a concrete sitting which should all be provided by the contractor. The tanker must be installed on the metal stand and should tightly be fixed (or roped) so as to resist the normal wind in the region.
- The contractor must supply and install the piping from the installed solar water pump to the tanker.
- The company must install the piping from the tanker to the water point.
- Pipes and connected materials should be provided by the contractor. The contractor should state all the necessary materials needed for completion of the work.
- The work shall include testing and commissioning and all related activities.

f) Construction of pump housing

- Well head with height of 0.75m should be constructed by the contractor.
- The contractor should provide a well head cover constructed using a metal sheet, size of cover 1.4x0.7x0.04m, c.f. pictures in Annex – IV.
- The contractor should supply and lay pipes, connect to water tanker & install flow controls.
- The company must connect piping, water meter, check and gate valve in the concrete closure (c.f. Annex – IV).
- All necessary materials for construction of pump housing and pipe installation should be listed and provided by the contractor.
- The work shall include testing and commissioning and all related activities.

g) Construction of water point

- The company should indicate the location for water point and construct at the proposed location (within the school compound) as per the drawing (Annex – V).
- The company must lay pipes from the tanker and connect to water point.
- The company must lay the pipes and construct a minimum of 8 faucets as per the drawing.
- The company must do the concrete work as per the drawing (Annex – V).
- The work shall include testing and commissioning and all related activities.

Annex – II:Site details and well characteristics

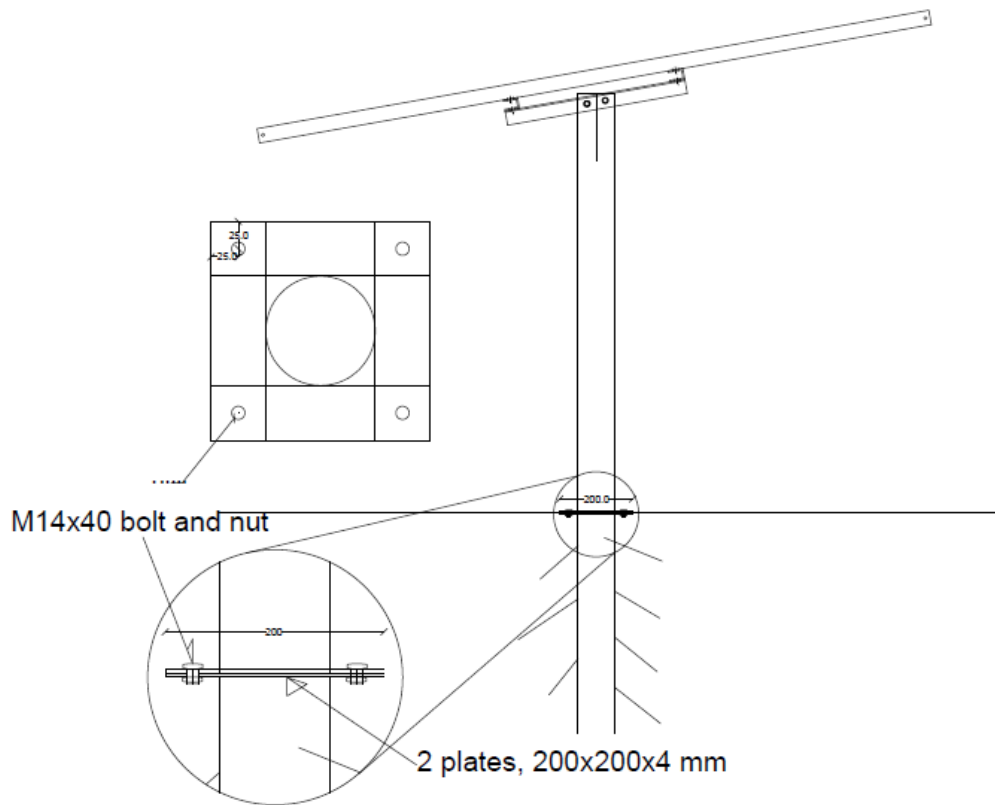
Sites Description

No.	School	Woreda	Zone	Region	Distance from Addis Ababa	Coordinates	
						N	E
1	Totose	Angolela Tera	North Shoa	Amhara	120 km	9°31'53.16"	39°27'12.22"
2	Kura Kemele	Burayu	Finfinne Special	Oromia	80	9°12'13.9"	38°36'18.1"

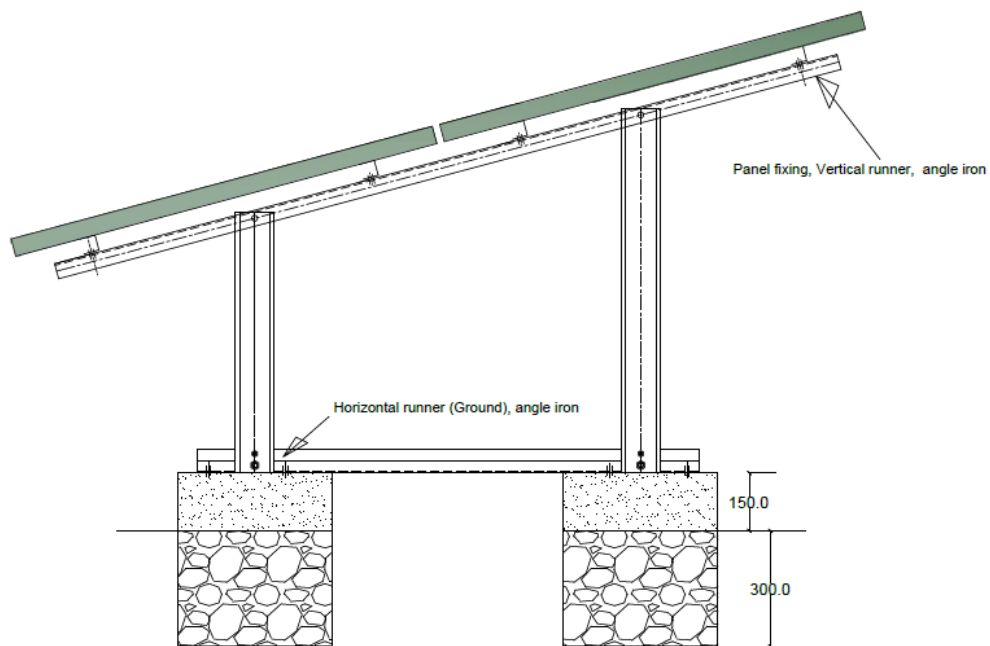
Well characteristics for design

Water Pumping System Parameter			
Information Required			
	Site 1 Totose (Amhara region)	Site 2 Kura Kemele (Oromia region)	Remarks
Volume of water required per day (m ³ / day)	5	5	
Borehole diameter (mm) (6 inch)	150 mm	150 mm	
Borehole Total depth	90 m	70 m	
Static Water level (m)	33.6 m	47.07 m	
Draw down (m)	5.2 m	0.8 m	
Dynamic water level (m)	39.8 m	47.87 m	
Pump position (m)	78 m	64 m	
Elevation difference Borehole to Tank (m)	4 m	4 m	The stand to be delivered and installed by the contractor
Tanker height (m)	-	-	This depends on the tanker to be delivered
Tank Volume (m ³)	5	5	This should be delivered by the contractor
Pipeline length to tanker (m) [Distance from borehole to tanker]	10 to 15 m	10 to 15 m	10m to be used for preliminary system design. It has to be verified after site assessment
Diameter of Delivery Pipe	-	-	To be suggested by the contractor
Pipe to be used	HDPE	HDPE	To be supplied by the contractor

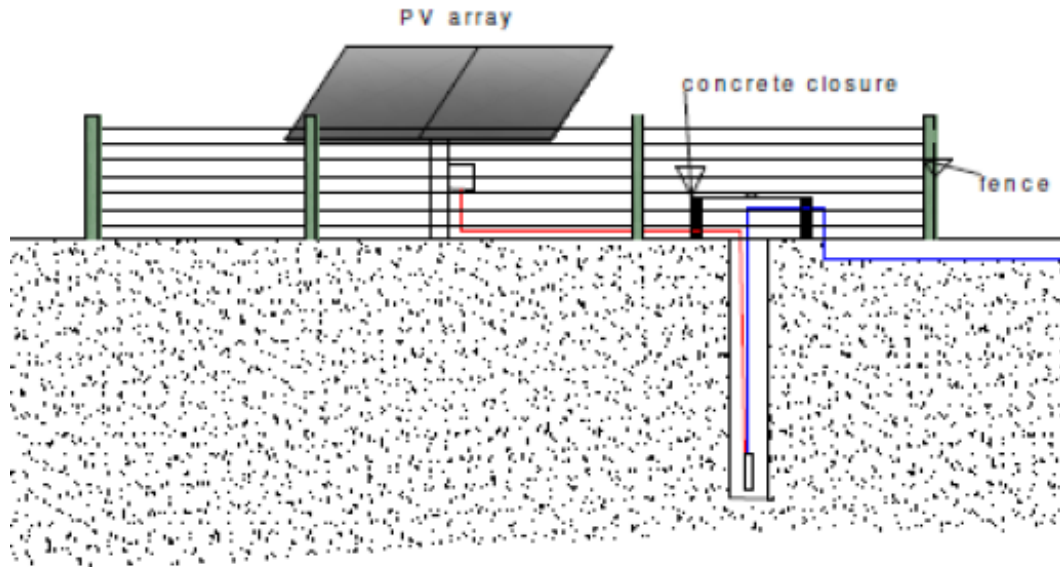
Annex – III: Sample designs of PV structures and fencing



Example 1: PV support structure with one footing



Example 2: PV support structure with more footing (pay attention for the details of the concrete sitting)



Example of PV fencing

Note:

- The fencing should be constructed using mesh wire and angle iron using concrete foundation.
- The PV panel and the well head must be fenced.
- There must not be any shading on the panel from the fence at the most sunshine hours throughout the day.
- The minimum distance from the solar panel to the fencing should be 1.5m in all directions.

AnnexIV: Supporting pictures for well head construction



Construction concrete base for well head



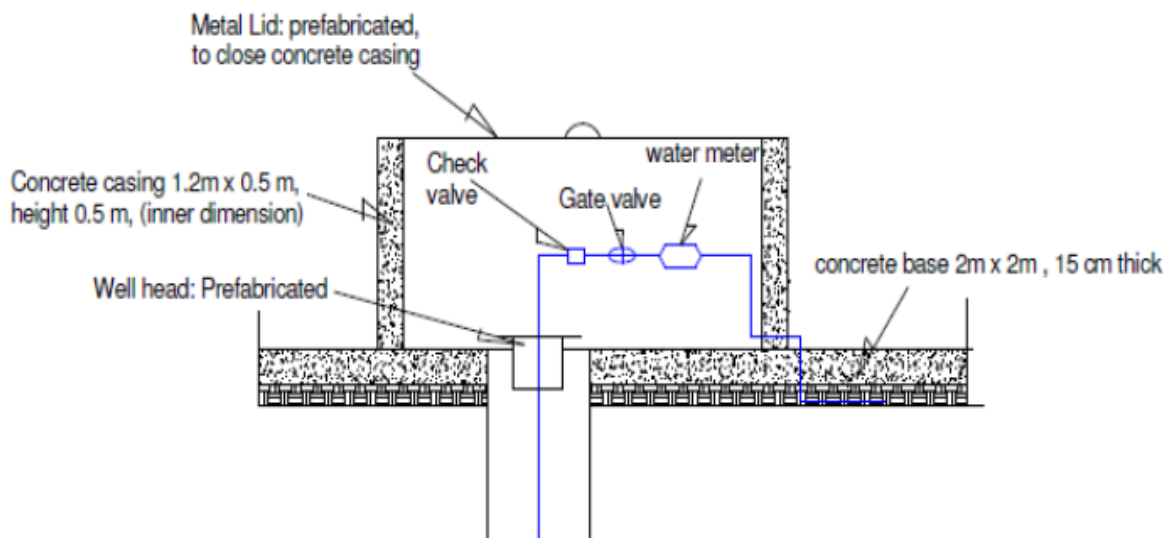
Incorporating well head into concrete base



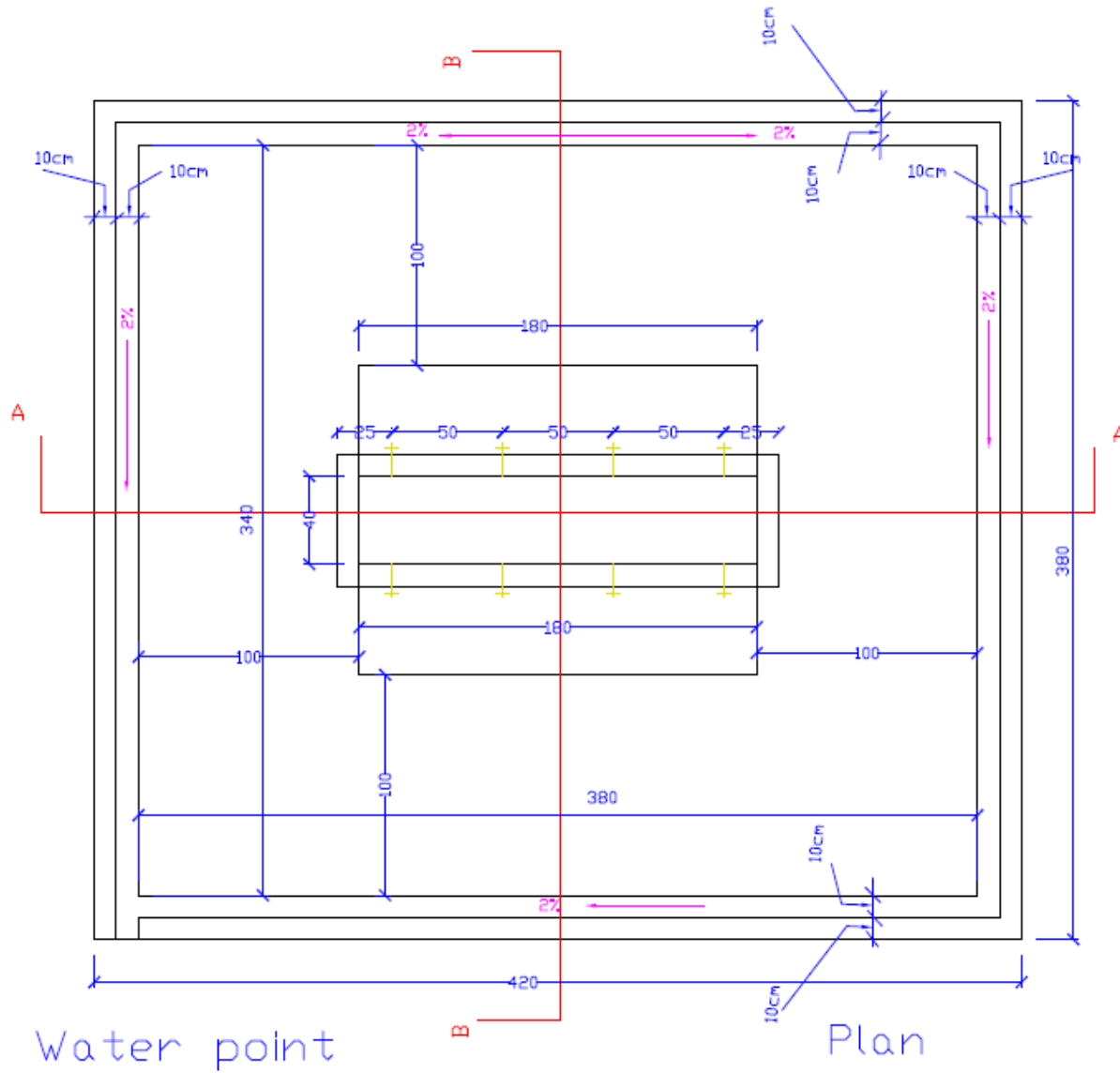
Pump Housing

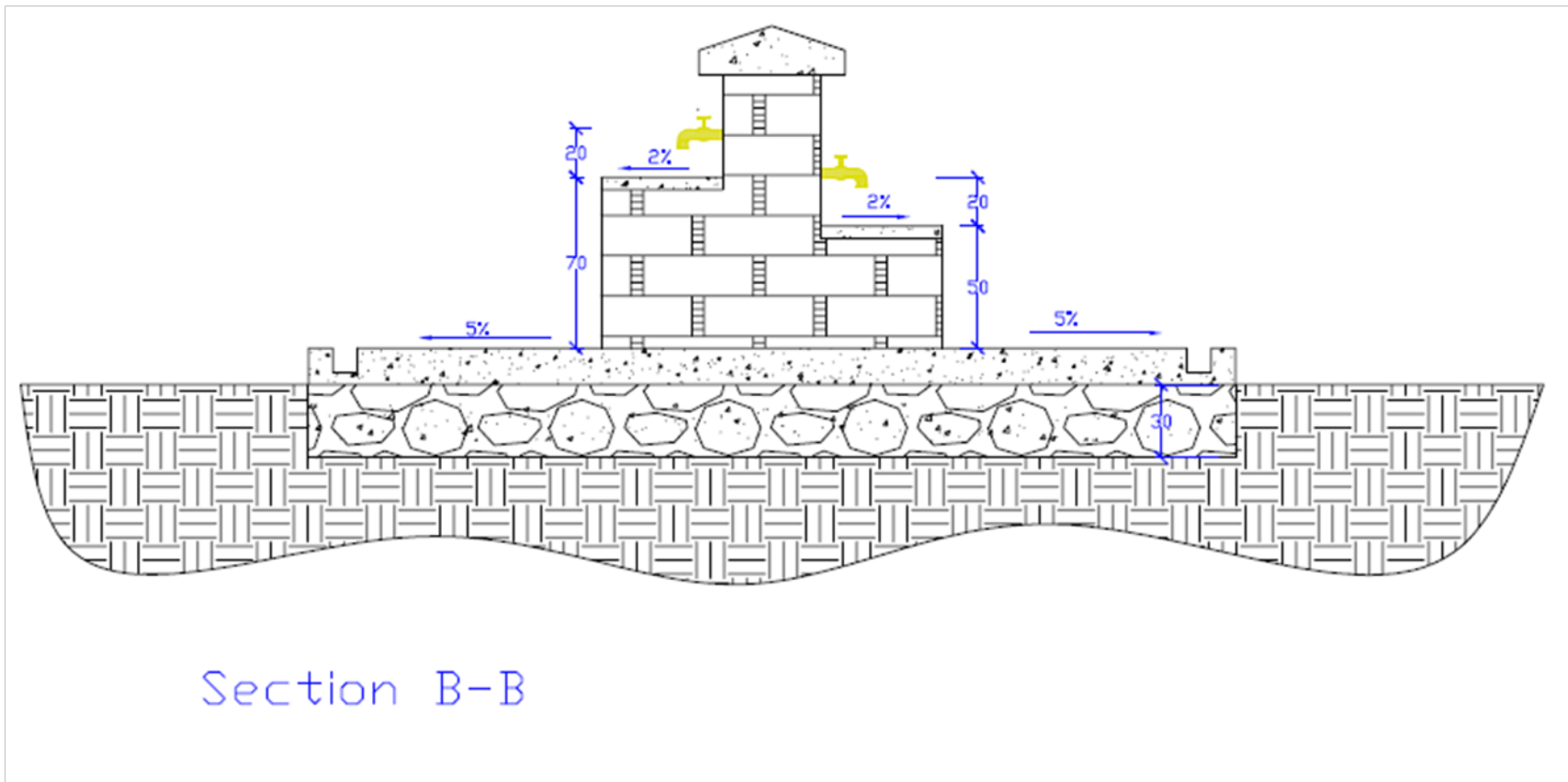


Well head with gate valve, meter and check valve



Annex V: Dimension for water point construction





Source: *Design and construction manual for water supply and sanitation facilities in pre, primary and secondary schools by Ministry of Education in collaboration of Water Aid Ethiopia.*

For Kura Kemele secondary school, the height of the water point on both sides should be 1m.

BoQ for Water point construction

S. No	Description	Unit	Qty.
1	Excavation & Earth Work		
1.1	Site clearing and excavation to a depth of 10cm	m ²	20.00
1.2	Bulk excavation to a depth of 30 cm	m ²	15.96
1.3	Cart away excavated material & deposit at a distance not exceeding 100m from the site.	m ³	6.79
1.4	30cm thick basaltic or equivalent stone hardcore, well rolled, consolidated & blinded with crushed stone	m ²	15.96
2	Concrete Work		
2.1	5cm thick lean concrete class C-5 , 150 kg cement / m3 concrete over the hard core	m ²	15.96
2.2	15cm thick plain concrete, C-20 for floor work	m ²	15.96
2.3	Plain concrete for copping	m ³	0.15
2.4	Provide cut and fix in position sawn zigba formwork	m ²	4.79
3	Masonry Work		
3.1	Trachytic or equivalent stone masonry work	m ³	34.29
3.2	Pointing of masonry work	m ³	4.22
4	Pipe and fittings		
4.1	3/4 inch HDPE elbow	No	5
4.2	3/4 inch HDPE Tee	No	4
4.3	HDPE reducer 3/4 x 1/2 inch	No	8
4.4	Faucet 1/2 inch	No	8
4.5	3/4 inch HDPE pipe (from tanker to water point)	ml	

Source: *Design and construction manual for water supply and sanitation facilities in pre, primary and secondary schools by Ministry of Education in collaboration of Water Aid Ethiopia.*

Note:

- The location of the water point is within 5 to 10m from the water tanker. This could be changed up on the site verification visit by the contractor.
- All the materials necessary for construction of the water point must be provided by the contractor.
- All the materials listed above are indicative only. The contractor could change the sizes of the piping but the construction of the water point such as the excavation & earth work, concrete work and masonry work should be as listed in the table above.
- All the piping must be using HDPE.