

**Terms of Reference for the Installation of 16 Mini-Piped Water Schemes in Waterfalls, Highfields and Kuwadzana Districts, Harare Zimbabwe.**

1. **GENERAL INTRODUCTION**

The COVID-19 pandemic comes at a time of increased humanitarian need which includes low service provision in Zimbabwe is currently experiencing the negative effects of the COVID-19 outbreak, which has claimed health care facilities, acute foreign currency shortages and limited stocks of essential medicines. These challenges continue to hamper urban water and sanitation access and improvements (including in Harare) and include as identified by the Ministry of Lands, Agriculture, Water and Rural Resettlement during the Joint Sector Review held in 2019: a) recurrent outbreaks, particularly of typhoid and cholera; b) dilapidated infrastructure and weak systems for operation and maintenance linked to low levels of service reliability; c) unplanned urban expansion and the related challenges of effluent and raw sewerage discharge into water bodies, wetlands encroachment, uncontrolled human activities along rivers resulting in siltation of major sources of urban water supply and mushrooming of illegal solid waste dumps; d) rampant countrywide open defecation; and e) limited availability of planning data especially for groundwater systems.

GOAL Zimbabwe has found funding to support government efforts in addressing these challenges as highlighted above that include the provision of access to adequate and safe water in a manner that would deter the spread of COVID-19. The response will target 4 districts in Harare, Mbare, Waterfalls, Highfields and Kuwadzana. And in pursuit of meeting the objectives of the project, GOAL Zimbabwe will be supporting and facilitating the rehabilitation or construction of 16 small PWSs in the 4 districts. Following successful 48 hrs capacity tests for the 16 boreholes, this document contains the complete technical specifications for a fix and supply, to the 16 Solar-PV Powered mini–Piped Water Supply Sschemes within the specified areas. The identified sites are as featured on the **table 1.1.**

**Aim**

The project aims to provide six solar powered systems in four Districts where mechanisation of existing boreholes will be conducted to increase supply of safe water to cater for a gap of water scarcity experiences within these four districts.

**Objectives**

The objectives therefore of this predominantly African Development Bank Funded project include:

* To reduce water shortages by supplying adequate safe water for domestic use in emergencies.
* Design of 6 solarised mini piped water schemes which are efficient and effective in supplying safe chlorinated water, the design to have inline chlorinator.
* Design and install systems with adequate controls and protections to be able to withstand weather anomalies.
* Develop an operation and maintenance plan, technical training of caretakers during works. To ensure that record initiation, operation and maintenance are promptly done during and after the installations.

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| --- | --- | --- |
| **Site Name** |  **Coordinates**  | **B/H Depth (m)** |
| Kuwadzana Extension  | -17.832512  | 30.896064 | 50 |
| Kuwadzana 3 Car Park | -17.827222 | 30.931191 | 75 |
| Highfield Gaza  | -17.891241  | 30.999171 | 86 |
| Highfields PWD | -17.885591 | 31.000248 | 60 |
| Waterfalls Retreat | -17.918027 | 31.054496 | 100 |
| Waterfalls Retreat 300 Area | -17.917879 | 31.054289 | 80 |

**Note: On every site there shall be a 20** **m3** **tank.**

## Scope of work

**Scope of General Specifications**

This specification covers the overall works to be done consisting of Civil works, installation of 20 000 litres Stora tank (for each scheme), Solar Power & Pump Installation, fix and supply of all materials and facilities for the complete civil works and placing in operation of 6 mini piped water schemes.

The prospective bidder will be expected to execute the whole of the civil works. The scope of this specification comprises:

Fix and supply of 6 suitable mini solar powered schemes. The solar arrays should be installed close to boreholes and must deliver a minimum of safe yield estimated from capacity tests which is up to a minimum pumping yield as a recommended safe yield per every site as per capacity testing results.

**1.2 Pumping Unit**

All pumps should be clearly labelled with visible serial numbers and manufacturer’s details. The system should be AC and solar modules to be installed near all boreholes, the safe yield for each borehole per capacity testing results, pump sizes per borehole will be determined by water capacity tests results. Each system should be designed to pump 90% of safe yield for a minimum of 5 hours during the day. Surge protector to be provided at the AC output of a single phase and three phase solar invertors, it will save the invertor from very high voltages that might be detrimental for the internal semiconductors.

**1.3 Security**

 **Permanent Fencing**

2 m palisade fencing with sharp ends and 0.15m spacing. All poles to have 1 meter buried on the ground covered with 0.4x0.4x0.6 m3 of concrete. Perimeter fence to provide minimum of 2m clearance between fence and protected equipment (solar panels, well, water tank, etc.) Security measures to be robust palisade fencing and proximity switched solar lighting. Lockable access gateway to provide pedestrian access into the fenced compound (1m x 1.8m high). 1.25'' inch borehole plate/cover for each water point properly secured.

 **1.4 Site Clearance**

The contractor shall seek permission for site clearance to all obstacles that may interrupt with solar panel positioning, safety should be practised, if any accident occurs the contractor will be accountable. GOAL Zimbabwe will not be responsible.

**1.5 Supply and Installation of main transmission and distribution lines (7241 metres for all schemes inclusive)**

Trenching, and supply & Installation of HDPE 50mm and 40mm class 10. Pipe to be laid as per provided drawings for every site, from outlet of manifold at boreholes to collection points. Pipe to be buried in trenches minimum depth of 600mm and 1000mm maximum depth on road crossings with backfill around the pipe using material free of stones or detritus. All backfill to be well compacted. All pipes to the right fittings. Pipes to be thoroughly cleaned before installation and all pipe always end capped. All pipework to be pressure tested and disinfected using any standard method.

**1.6 Tank**

Community systems shall be installed with the tank adjacent to the borehole and panel array – and all equipment enclosed within a suitable security palisade fence. Supply and installation of **20 000L** water tank for every scheme, elevated on steel stand 6m above the ground level. All fittings which include all inlet and outlet fittings, float switch, water level indicator, and washout. To include valves on each of the outlets. Tank to be of PVC or HDPE, certified as suitable for potable water. To include all foundation works. Inlet should be equipped with float switch to control the pump.

**1.7 Tank stand**

Tank stand design should be undertaken/approved by a qualified, registered, structural engineer and submitted to GOAL for approval before commencement. The tank stand shall be 6m above the ground level and the contractor shall provide a certified tank stand design clearly labelled with dimension, the design shall comprise a safety ladder to the top should be prioritised and in accordance with applicable safety standards. Detailed concrete foundation designs should also be provided. Tank platform should be able to securely support the tank and design the platform spacings should be clearly labelled. The tower shall provide 6m of elevation and will be supplied with a valid structural analysis certificate stating that the tank stand is suitable to carry a load more than 10 .5 tonnes. General arrangement (GA) drawings shall be provided with the bid documents.

All required rest platforms and safety cages will be included.

**1.3.6 Deck Perimeter Guardrail.**

A deck perimeter guard rail will be provided. The guardrail will have top rail, mid rail and toe board and will be galvanized.

**2.0 ENERGY PACKAGE COMPONENTS**

**2.1 Solar-PV System Specifications**

 **General introduction**

This section covers the specification of works for the abstraction of water from the source using solar energy related equipment here collectively referred to as Solar Photovoltaic [SPV] water pumping system/plant. The modules, panels and array shall be referred to as Solar-PV modules, -panels and -array respectively.

When designing and installing the system, the following precautions shall be taken into account.

* The solar array shall be able to support pumping unit of at least 90% of safe yield for a minimum of 5 hours a day and should be close to the water source to minimize voltage drop precautions and installation cost.
* The tilt angle for solar arrays to the horizontal must be 18⁰ of installation on the relevant location. The structures shall withstand wind speeds of 120km/hr.
* Only certified high voltage Polycrystalline and Mono-crystalline silicon modules are generally acceptable. The modules should be certified for compliance with the following specifications:
* International Electro-technical Commission (IEC) 61215/61646 - 1993, Crystalline silicon terrestrial photovoltaic (PV) modules - Design qualification and type approval (or most recent edition).
* The contractor shall provide a solar stand/module design that has tight security against theft, all security features shall be clearly listed which are difficulty to un-screw the solar modules or metal parts from the entire assembly.
* Solar modules to be mounted preferably on a 150mm diameter round tube 6m high above the ground level (Other designs might be acceptable according to design and material used), shall be fixed (non-tracking), after installation.
* The structure shall be ground mount and all materials used with the associated standard of works, shall comply with the specifications for rust-free/corrosion resistant metal works. The contractor shall as well furnish warranty certificates for each major component (solar-PV modules, Inverter, Water Pump) obtained from the equipment manufacturers. The warranty certificates for solar-PV modules, inverters and pumps shall be Twenty-Five (25) years, five (5) years and Two (2) years respectively
* The contractor to provide a detailed design of solar modules complete with foundation detailing, this should be sent as a hardcopy as well as AutoCAD drawing.
* All tamper proof screws shall be applied on mounting solar panels, solar PV modules should be mounted in a way that no one should easily unscrew.
* Due to the complex nature and multiple variables involved in calculating solar system performance, the system must be designed and planned using computer-based tools e.g. Lorentz compass, that can closely model the irradiation, power generated from the solar array, ambient temperature, and typical pump performance and can verify this through comparison with installed systems which allows 90% pumping safe yield for a minimum of 5 hours a day throughout the year.

#### **Control Equipment**

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

Control equipment must:

* provide diagnostic indicators to show status.
* have provision for continuous performance measurement.
* Shut off pump when tank is full
* Protect the pump from damage due to fault – including dry run protection.
* The control equipment must meet EN 61800-1, EN 61800-3, EN 60204-1 or internationally recognised equivalent standards.
* Control equipment must be positioned at 0.5 to 1.5m from ground level for ease of servicing, adjustment, and system health diagnostics

#### **Ease of Servicing**

Control equipment must have simple system health indicators that are user visible for trouble shooting purposes – typically of pump status, pump speed, well dry, tank full information.

#### **Environmental Protection**

Control equipment must be housed in a suitable enclosure of robust design for mechanical and environmental protection to at least 2m or higher.

#### **Warranty**

The bidder 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.

**2.1.6 Pump specifications**

The proposed pump shall be examined to determine its suitability for the installation, pump size shall be according to safe yield provided in Water Capacity Testing Results for every site and Shall be of recognized good quality make such as Lorentz or Grundfos. AC motor, with stainless steel impellors. Shall be of recognized good quality make such as Lorentz or similar A 50mm in diameter flow meter shall be provided within the yard just a few meters from the borehole.

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

* 1. **Tap stands**

Design and installation, contractor is expected to design a water abstraction point suitable for the proposed locations. The designs shall consist of a minimum of 4 taps. An apron shall be designed in a way that all wastewater will be directed into a drainage or a designed soakaway at least 5.0 m away from the tap stand. The taps shall be half a meter apart from each other and approximately 1.0m high.

 All collection points to have palisade fence. Ramp access to taps suitable for people living with disability. All globe valves to be adjusted during commissioning so that flow from each tap should be uniform.

**2.5 Valves, Bulk meter & Inline Chlorinator**

The contractor shall supply & install all valves, bulk meter, inline chlorinator including connection to pipe and installation of protection boxes. Protection box to be securely covered so unauthorised access to the valve, water meter or inline chlorinator would be impossible.

* 50mm Globe Valve
* Alternative: 50mm Gate Valve
* 50mm Water meter

All valves, bulk meter, and inline chlorinator to be protected against vandalism, thus the housing unit shall be lockable. The contractor to provide a design for protection box of these components, and they shall be installed not more than 5m away from the tank stand and shall be protected by a security fence.

1. **Pipeline Markers**

Installation of reinforced concrete marker posts 1 metre tall, 20 x 20cm x-section. To be installed at all junctions and at 150 metre intervals along the length of the pipe. 0.5m to be buried underground 0.5m over ground. All pipe markers to be clearly marked with unique identifier. At least 3 markers should be installed on every mini piped water scheme.

#### **3.1 Spare Parts**

Parts should be replaceable at a low level of modularity to reduce replacement costs. Spare parts must be readily available on site within 5 days. The bidder must recommend the items that would be supplied in line with manufacturer’s recommendation (3 and 5-year spares).

**4**.  **Zimbabwean standards and Other Documents General Specifications:**

 All services & Goods supplied should be fit for purpose, in good condition, and comply with the latest relevant Zimbabwean standard. When no appropriate standards, South African standards will be acceptable.

Particular Specifications; ZW S21:96

Welded steel fabric for reinforcement of concrete and masonry

 **ZWS 428 & 414: 1996**

 Paints-praying properties of paints

 **ZWS 149:1993**

Cast Iron Valves for Water works

 **ZWS 170**

The structural use of concrete

 **ZWS 351: 1993**

 The protection of structure against

 **ZWS 521: 1996**

 Steel fabric for reinforcement of concrete and masonry.

 **ZWS 327**

 Part 1: 2003 components of pressure pipe systems uPVC pressure pipes.

ssPart2:2002 modified- mPVC pressure systems **ZWS 177: 1976**

Black polythene pipes for called water services  **ZWS 170**

The structural use of concrete

 **ZWS: 240:1999**

 Electric cables

 **ZWS 428 & 414: 1996**

 Paints -spraying properties of paints

 **ZWS 149:1993**

 Cast iron valves for water works