



Technical Specifications

1.0 Scope of works

GOAL intends to engage successful contractors on an admeasured contract for rehabilitation of 96 boreholes in Butaleja, Butebo and Kaabong districts. The rehabilitation works shall involve general overhaul and replacement of the water columns, disinfection and flushing of wells, reconstruction of new or hacking and re-plastering of the existing aprons and drainage channels and reconstruction of the Borehole (s) surrounding soils and soak pits; as specified hereinafter and as will be directed by the Client.

The technical documents represent a standard scope for rehabilitation works. Specific rehabilitation requirements for each borehole will be issued to the contractor(s) at site handover. Where deemed inevitable, **A successful contractor may be awarded works across two districts.**

The scope of the work requires that contractors furnish only satisfactorily rehabilitated boreholes to the client. A satisfactorily rehabilitated borehole is defined as one rehabilitated as per the requirements clearly reflected in the working documents i.e., the Bill of Quantities (BOQs), technical Specifications and Drawings.

All wells will be installed with U2 hand pumps with either stainless steel (G304 steel) pipes and rods or Upvc pipes with stainless steel coupling, on instructions from the GOAL Supervisor. All depths of installation and overall work scope for each borehole will be approved by GOAL.

Location of the works

The works are in communities in Butaleja, Butebo and Kaabong, Districts.

Borehole Overhaul:

The contractor (s) is to overhaul all the **boreholes** allocated; removing all the water columns (Cylinders, rising mains and connecting rods) and some mechanical pump parts above ground level that are not in good working state as per the BOQs and hand them to the supervisor / respective

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District Water Offices (DWOs). Records of all pump parts retrieved should be kept and will form part of the completion report submitted for the whole work. Evidence of receipt of these materials by the respective DWOs clearly reflecting numbers should also form part of the final report.

The Client representative will inspect all the tools before works commence to ensure that the contractor uses the right tools for the works.

The contractors should ensure that the personnel on site are suitably qualified and experienced person(s). The nominated person(s) shall be available for the specified contract period. Proposed changes to the personnel should be agreed with the supervising engineer/GOAL.

During the rehabilitation works, the contractor should ensure that representatives of the local community/institution shall be involved. GOAL will assist with community liaison activities.

Borehole Disinfection (see detailed specifications for borehole disinfection in Annex 1)

All boreholes shall be disinfected off both fecal and metal corroding bacteria using High - Strength Calcium Hypochlorite (refer to the Terms of Reference for borehole disinfection)

Water Quality Testing

Water quality testing of the borehole water will be a precursor to the Borehole rehabilitation works. Sampling for physio-chemical analysis shall be the responsibility of the client. However, where the client requires that the contractor carries out the tests, Water samples shall be delivered to an approved water quality analysis Laboratory. The contractor shall meet the cost of water quality analysis and original test certificates shall be handed to the client. The test certificates shall form part of the final borehole completion report by the contractor.

Sampling:

For non - functional Boreholes, the contractor will temporarily install the source to be able to draw the water. In this case, he will be required to pump it until the discharge is visibly clear before taking the sample, filling the sample bottle /container to the brim, seal and label it ready for delivery to the approved water quality laboratory. Afterwards, the water sources shall be uninstalled while awaiting the water quality analysis results.

For functional Boreholes, the contractor will directly take the sample from the borehole while being pumped (refer to the preceding paragraph) and thereafter leave it in its functional state until such a time when the water quality analysis results have been reviewed and declared to be satisfying the national standards for safe drinking water.

Sampling for Water Quality analysis shall be carried out in the presence of the supervising Engineer or the approved clients' representative on site. The contractor should include any extra cost for the delivery of the samples to the laboratory within this timeline in the respective BoQs items.

The samples should reach the laboratory within 24 hours from the time of collection. Specific parameters to be analyzed include:

- **Physical Parameters** – Colour apparent (PtCo), Turbidity (NTU), Electrical Conductivity ($\mu\text{S}/\text{cm}$), TSS (mg/L), PH
- **Chemical Parameters** – Nitrate(mg/L N), Total Hardness (mg/L), Fluoride (mg/L F), Chloride (mg/L Cl^-), Sulphate (mg/L SO_4^{2-}), Total Iron (mg/L Fe) Manganese (mg/L Mn), TDS (mg/L), Calcium (mg/L Ca^{2+}), Magnesium (Mg/L Mg^{2+}), Bicarbonate (mg/L CaCO_3), Alkalinity (total mg/L CaCO_3)

Environmental protection of the site

Care must be taken in the handling and storage of the disinfection chemicals and fuel to avoid introducing environmental contaminants and pollutants to the environment. The contractor shall safely dispose of any toxic materials including construction debris, discharged waters in a manner approved by the client and so as not to contaminate/pollute public and private property. The contractor shall adhere to relevant national regulations and guidelines on environmental protection that apply to drilling/ borehole construction. The contractor shall ensure that all their personnel are aware of environmental protection requirements and **MUST** ensure that the community is not within reach; while the borehole disinfection exercise is being conducted to avoid chemical contamination by inhaling.

Materials for the works and Workmanship

Materials that will form part of the complete works must be supplied new and never used. Materials must comply with the minimum specifications in the relevant codes. Materials not specified here must comply with the minimum specifications in the relevant codes of practice. Where a national standard does not exist for the material, the relevant British Standard shall apply.

The contractor is expected to carry out all works as specified and in a professional manner. The contractor shall carry out operations in accordance with the terms of the contract and to the satisfaction of the client. The contractor shall use suitable equipment and supply efficient and experienced staff.

- a) The contractor will provide an experienced project coordinator to oversee the whole rehabilitation works to be carried out under this contract.
- b) The contractor will maintain a full crew on each rehabilitation unit. If a member of crew quits for personal reasons or must leave because of illness or injury, the contractor will replace him as soon as possible with a worker of similar experience.
- c) If the client is dissatisfied with the performance of members of the crew, such members shall be informed of their shortcomings and warned by the contractor. If no change results within a reasonable period, the contractor will be notified and requested to take necessary measures on the unsatisfactory crew member.
- d) In the case of absence of one or more members of the rehabilitation crew the decision of whether to proceed with operations will be at the discretion of the client however, works shall be halted if the appointed contractor's site supervisor is not onsite.

Contractor to provide all equipment for the works

All necessary machinery, equipment and materials to carry out the boreholes overhaul and re-installation, disinfection, flushing, apron and drainage channel construction works shall be provided by the contractor. Prior to mobilization, the Client shall verify the specifications and state of repair of all major items of plant and transport, and shall have the right to order the removal and/or replacement of any items which in his opinion

are insufficient or in unsatisfactory condition. Acceptance by the client of the contractor's proposed plant and transport does not relieve the contractor of his obligations under this contract, in cases where such plant and transport accepted by the client fails to successfully complete the required works.

Borehole depth and diameter

The Contractor shall consult with the respective District Offices and line Ministry for the Borehole construction data if need be. This will be additional data to the data provided by GOAL. This data will be useful for calculating the chlorine dosing rate while disinfecting the wells. ***Refer to Annex 1 on Borehole disinfection.***

Verticality and Alignment

The contractor's works shall whatsoever not change the Verticality and alignment of the well casings and if this occurred, the contractor shall replace the well by re-drilling, at his own cost. The abandoned well shall be backfilled and or, capped. No payment shall be made for re-drilling, the sealing/backfilling of the abandoned well, or for moving to a new site. Any materials (i.e., casing, screens, gravel pack, cement, etc.) lost in the abandoned well shall be at the contractor's cost.

Loss of equipment

Any equipment lost down a well must be removed by the contractor or the well shall be considered a lost bore. A replacement well shall have to be constructed at the contractor's expense. The contractor shall not be entitled to further payments for such a well.

Lost bore

If completion of the well is prevented by any of incident to the plant, behavior of the ground, jamming of the tools, or casing or any other cause, the well shall be deemed to be lost and no payment shall be made for that bore or for any materials not recovered there from, nor for any time spent while attempting to overcome problems.

In the event of a lost bore, the contractor shall construct a new well. The option of declaring any bore lost shall rest with the contractor, subject to the approval of the client.

A lost bore shall be treated as follows:

- a) Any material supplied by the employer and salvaged damaged shall become the property of the contractor, and the contractor shall compensate the employer accordingly.
- b) The lost bore shall be sealed by concrete or cement grout, which shall be placed from the bottom upward by methods approved by the client.
- c) The upper 2 meters of the lost bore shall be backfilled with native topsoil. Sealing of such

abandoned wells shall be done in such a manner as to avoid accidents or subsidence, and to prevent it from acting as a vertical conduit for transmitting contaminated surface or subsurface waters into the water bearing formations.

Water supply for the works

The contractor shall make his own arrangement for obtaining, transporting and pumping of water required for the works and for use by his crew at their camp site.

Development and cleaning of wells

Well development/flushing shall be undertaken for all wells. Development and cleaning of the wells in this case will be done to circulate the disinfectant all-round the well linings, remove the rust deposits of corroded Galvanized iron pipes, remove native silts and clay accumulated overtime and flush out the chlorinated water from the well.

For circulating the chlorinated water all round, the well lining, the method adopted for development should be able to create adequate turbulence in the water without flushing any out: *this should be done for at least 2/3 hour. (Refer to Annex 1 on Borehole disinfection).*

The borehole should thereafter be flushed until the chlorine smell is insignificant, the water is free of fines and turbidity. This should be done continuously for a period of 90 minutes or, until there is no smell of chlorine in the water.

Whenever possible, natural well development must be used. During development, Cleaning may be carried out by airlift pumping, surging, backwashing or jetting, to the approval of the client. Clay de-segregation by means of Sodium Hexametaphosphate (“Calgon”) treatment may, in some cases, also be called for by the Client.

The method proposed by the contractor for development of wells shall be submitted to the client in writing for his approval. Development of wells shall be effective from the depth at which water is encountered to the bottom of each well. Development shall continue for such time as directed by the client and until the client is satisfied that the water is as free from fine particles as possible. Upon completion of development, any accumulation of material shall be removed from the bottom of the well by airlifting.

The contractor shall include a description of the well development data to form part of his completion report. A brief report on the Colour, smell and content of the water during development and the time taken for the water to clear if it had become turbid or cloudy at any one

time shall be well captured by the contractor.

Capping of well

During rehabilitation works, the contractor shall assume the responsibility of well and must therefore also use all reasonable measures to prevent entrance of foreign matter into the well. The Contractor shall be responsible for any objectionable materials that may fall into the well and any effect it may have on water quality or quantity until completion of the Works and acceptance by the Client.

Acceptance of well

The Client shall accept the well upon satisfactory completion of all works executed with stringent adherence to the attached Technical specifications, BOOs and Technical drawings.

Standby time

In the event of delays because of the action or inaction of the client, for which the contractor would be entitled to claim standby time, the contractor shall notify the client immediately in writing. A claim for standby time is only effective if all the contractor's plant, equipment and personnel are on site, available for work and in a serviceable condition. Standby time shall not exceed the standard working day as defined in the contract data, and any claim shall only be deemed to start at the date and time of a notice in writing to the client.

Concrete apron/platform casting and hand pump installation

For platforms requiring complete replacement of the aprons and drainage channels, the contractor shall construct concrete platform for such boreholes carrying out the following activities in order:

Excavate square pit 760x760x400mm deep around the casing pipe. Remove topsoil all-round the square pit to a depth not exceeding 200mm and to a radius of 1m from the pedestal and, level the ground ready to receive platform concrete. Remove also the topsoil to the depth not exceeding 200mm for all the area on which the well drainage channel will be constructed.

1. Place stand assembly (pedestal) over casing pipe, ensuring that the third leg (corresponding to the water tank spout pipe position) faces the proposed direction of the

drain.

2. Making sure the pedestal is vertical, construct concrete in layers of 100mm up to top level (gl).
3. Cover stand assembly with a cover plate
4. Place 200mm of a hardcore bed on the surface ready to receive a concrete bed for the apron and drainage channel and cast 50mm thick bed concrete (mix 1:2:4/20mm agg.) over the hardcore bed.
5. Lay the mild steel shuttering (moulds), place the reinforcement bars - 10mm ribbed r/f bars and wire mesh fabric as detailed in the drawings and cast platform in mass concrete (mix 1:2:4/20mm agg.) conforming to the dimensions and other specifications shown in drawings.
6. Plaster platform and drain in cement screed to a smooth finish, then engrave the borehole details provided by the client on the platform. The contractor should maintain and engrave the;
 - **Name of the original funder of the Borehole construction works**
 - **Initial Borehole construction date.**
 - **The statement “Rehabilitated by C:W / GOAL”**
 - **Date of Rehabilitation.**
7. Cure concrete for 5 days and protect it from excessive sunshine (using gunny bags or sand dams) and thorny bushes as protection against vandalism by animals

For aprons and drainage channels that will not be replaced, hack all-round the concrete structure and re-plaster with mortar of mix ratio 1:3; re-plaster and neatly finish the surfaces.

Contractors should note that the client shall not sanction platform reconstruction without the borehole installation materials onsite. This is to avoid a situation where the contractor(s) take longer than expected to install the wells, depriving the communities of their right to water. The installation material in this case shall be kept with the community leadership. The contractor shall ensure that respective community leaders acknowledge receipt of this material in writing.

Hand pump equipment and installation

The Contractor shall supply pipes and pump parts, to cast and install India Mark II; U2 Deep well Hand pump as per Bureau of Indian Standard Specifications IS-13056: 1991, Bureau of Indian Standard Specifications IS- 13056: 1991 – Amendment 6, with 50mm dia. cast iron brass sleeved open top cylinder assembly with extractable plunger and foot valves assemblies or a similar specification according to Uganda standards.

Pump cylinders

All wells with depths beyond 39m are to be installed with heavy duty extra deep well cylinders with three washer cups or valves. **The client must confirm the cylinder before installation.**

Clearing the site

Upon completion of works on a well site, the site must be left free from debris, hydrocarbons and waste, and all pits must be filled up. A site not delivered clean may render the well unacceptable.

Records and Reporting

The contractor shall keep daily activity records for each borehole. The records shall contain the information as specified below. The notes collected per site shall compose the rehabilitation completion report.

i) Daily Record

- Site name
- Reference number of borehole if any
- Date of reporting
- Names of foreman and borehole installation technician
- Records of the pump parts removed, replaced and refurbished (Pedestal and water tank)
- Static Water Level (SWL) and borehole depth in metres
- Problems encountered during the works if any.
- Installation depth
- Duration of borehole flushing and disinfection

A copy of the daily record shall be made available daily to the supervisor and should include any other pertinent data as may be requested by the Supervisor.

ii) Reporting

The completion report that the contractor shall submit will capture the details from both daily record and borehole disinfection.

Annex 1: Borehole disinfection

Introduction

The contractor shall carry out borehole disinfection by chlorinating all wells in conformity with the procedures outlined in the Terms of Reference (TOR). The Procedure and findings of the borehole disinfection exercise will form part of the completion report presented at the end of the borehole rehabilitation works.

Scope of Works:

The contractor, by accepting the terms of this contract with the client, accepts and understands that the primary purpose of conducting borehole disinfection is to kill the bacteria. This includes coliform bacteria that may indicate the presence of disease-causing organisms and other nuisance bacteria (examples are iron and sulphur bacteria) that can cause unpleasant taste and odour in the water.

The scope of works will be to:-

- Calculate the dosing rate by measuring depths and static water levels of boreholes. The contractor shall also carry out a desk study by visiting Kaabong district water office to establish the borehole design details i.e. The well diameter and screen depths of each borehole.
- Carry out disinfection of all boreholes using High-Strength Calcium Hypochlorite (HSCH) in powder or granular form with 70 to 74% chlorine concentration.
- Provide a detailed report giving at least: the static water level, diameter of the well, depth of the well, dose rate and volume of water in the well for each rehabilitated well/borehole.

Procedure:

- a. Dismantle the borehole removing all the below and above ground pump components leaving the pedestal open.
- b. Pour mixed chlorine solution into the open well (the suspended solids left behind after the mixture settled should be discarded). The mix proportions of the disinfectant should be well calculated using the well dimensions. Refer to item 4 below.
- c. Using a hosepipe connected to a compressor, lowered into, and through to the bottom of the well, introduce low pressure from the compressor, adequate to agitate the water (surging); creating turbulence to only circulate the chlorinated water back and forth through the screen, gravel pack and adjacent aquifer matrix for 2/3 hour. Ensure that the chlorinated water does not flush out of the well until the disinfection exercise is complete.
- d. Flush out the chlorinated water from the borehole for 1.5 hours or, until there is no smell of chlorine in the water

1. Calculating the chlorine dosage for disinfecting a borehole using high- strength calcium hypochlorite (HSCH)

a. Equipment

- i. 20 litre bucket
- ii. HSCH granules and powder

b. Calculate the volume of the water in the borehole using the formula:

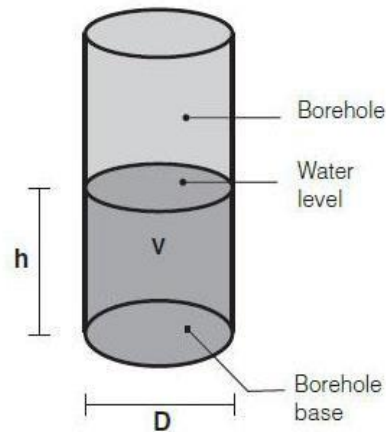
$$V = \frac{\pi D^2 h}{4}$$

Where V = volume of water in the borehole(m^3)

D = diameter of the well(m)

h = depth of water(m)

$\pi = 3.142$



- a. Multiply your answer by 1000 to convert the answer to litres
- b. Divide the volume of water (in litres) in the borehole by the volume of the bucket to establish how many buckets of disinfectant will be needed to replace the total volume of water in the borehole
- c. Fill the bucket with clear water
- d. Add 1.5g of HSCH powder and stir until dissolved (0.75g for every 10 litres in the bucket) which is equivalent of 52.5mg/l of chlorine (Taking 70% of 0.75g of HSC)
- e. Pour the disinfectant into the borehole
- f. Make up sufficient buckets of disinfectant to replace the total volume of water in the borehole.

Precaution

- HSCH gives off chlorine gas, which is a serious health hazard. In this regard, therefore, always add chlorine compounds to water rather than water to chlorine.
- The preparation of the Chlorine solution should be done in the open or rather in well-aerated area with a good flow of air.
- Wear protective gear; especially face and eye masks and gloves.
- Do not allow anyone to use the hand pump during the cleaning process.