

Specific Technical Part

1. To be provided by the contractor:

- Transportation of all equipment, materials and staff to the sites;
- Drilling works,
- Physio-chemical and bacteriological analysis of the water found in the bore hole by a certified laboratory;
- For bore holes with sufficient yield and water meeting National and WHO standards for drinking water only:
- Insertion of 5" certified UPVC casings and screen pipes into the borehole.
- Supply and installation of approved (heavy) duty U2 or U3M pumps (Complete) 32 mm or 1 1/4" stainless steel riser pipes and connecting rods in 3m length with O ring welded seamless sockets in AISI304. 1Pc of nipple adaptor stainless AISI 316; or equivalent also inclusive of handle guard rail fabricated with used 1 1/4" inch diameter GI pipes as approved by the engineer. Installation materials will be inspected upon delivery and sub-standard quality rejected.
- Report indicating the characteristics of each of the successful and abandoned bore holes;
- Hand-over procedure with UWA

2. The offered price includes:

- Transportation;
- Use of tools, machines and equipment;
- Materials, such as water, fuel etc.;
- Any stores and storage costs;
- Laboratory and costs of reporting;
- Staffs (supervising water and drilling engineer, technical drilling team, drivers, masons and other craftsmen, any casual labourers required; etc.);
- All staff cost such as salaries, allowances, medical treatments, etc.
- Equipment: Trucks, machines, compressor, drilling rig, tanks for water and fuel, etc.
- Equipment and material for pump, apron: U2 pump complete with all accessories and spare part kit, cement, steel reinforcements, sand, aggregates and boulders, plus all auxiliary material such as timber for casting, nails etc.,
- Any taxes and charges should be included in the bid amount.

3. Payments

Payments are done under the condition:

i. Payment for Dry Holes._

That means: If the bore hole is dry or if the yield is low (i.e below 500 litres/ hour based on a 3hour pumping test), then the borehole shall be declared dry /low yield and the contractor shall charge the client the amount indicated for a dry/low yield hole in the BOQ.

In case of dry boreholes or boreholes with insufficient yield, the Contractor is to drill another borehole based on the hydrological survey with the permission of the Client's Drilling Supervisor.

Payment for fully functional boreholes shall always negate the unsuccessful borehole line item in the BOQ. Payment for functional boreholes is based on ad-measurement of materials and depths.

ii. Payment for Abandoned boreholes (Unfit Water Quality or Dynamic water level below 45m below ground level)

A borehole can be considered abandoned, and paid for as such; if any content of the pumped water is not suitable for human consumption, or if any parameters such as nitrate, salt, fluorides, etc. are exceeding the permissible standards for potable water according to Ugandan standards for drinking water; or If the static water level is more than 45m or stabilized Dynamic Water Level of more than 45 meters at minimum acceptable discharge of 500 litres/hour Such a borehole shall be abandoned and the contractor shall charge the client the amount resulting from materials used and BoQ items utilized to the point of this declaration, based on the contract's BoQ appended to the contract. The payment for abandoned boreholes should not be confused with payment for a dry or low yield borehole captured in clause 3 above or technical failure captured below.

iii. Payment for Technical Failures

A borehole is declared a technical failure if, in the course of drilling, the contractor fails to construct a borehole according to design specifications, as a result of inefficient tools, geological challenges, loss of tools/equipment, loss of drilling fluid circulation, etc. Technical failures are considered an inability of the contractor to adopt to the geological issues pertaining the site, resulting in failure to construct a well to meeting the contractual specifications.

Technical failures are not compensated (not paid) for by the client in anyway. The contractor is required to make good of the site.

4. Location of the boreholes

The exact site locations in the field are provided in the siting report made available to the contractor. The general site location is presented below:

1. Kaekem (3.76729°N, 33.84393°E)
2. Karua (3.92512°N, 33.81983°E) / Alternative site; Natedekitoi (3.90524°N, 33.851918°E)
3. Nataba Gate (3°41'14" N, 33°49'13" E)
4. OP Lokorimongin (3°53'16" N, 33°42'29" E)
5. Lokumoit Gate (3°38'26" N, 33°42'56" E)

TECHNICAL SPECIFICATIONS AND PROCEDURES FOR DRILLING AND CONSTRUCTION OF DEEP BOREHOLES.

1 General items

- The execution of works has to be according to the technical specifications of this tender document and must respect the norms and standards valid in the Republic of Uganda. If national standards do not exist, relevant international standards or rules, namely those issued by USAID, will be applied.
- An A&E consultant for the client will follow and supervise continuously and on daily basis the works, be it by the project manager, be it by his representatives on site. The remarks of Supervisor's staff will have to be followed. No work will be expected to continue without the presence of the client's representative unless otherwise this is agreed upon in writing.
- Every modification of the contractual works or the time schedule must be confirmed in writing, in the form of contract annexes, amendments or modifications. Verbal arrangements are not valid.
- The contractual time schedule has to be followed. Occasional rain, bad weather, holidays etc. have to be taken into account when the Contractor sets up his time schedule. **The same applies to technical problems with the vehicles and/or drilling equipment. Such factors will not be accepted as reasons for delay.**
- The Contractor will respect the rules of security on site. He will be fully liable in case of accidents, damages etc. to his staff, workers and/or thirds parties. At night, the site must be protected as well.

2 CONTRACTOR'S DRILLING EQUIPMENT

- i. The Contractor shall specify in the Schedule of Drilling Equipment, borehole development; test pumping and other accessory equipment, its 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. It shall at all times be kept in full working order and good repair. For example, the test pumping equipment must have the relevant capacity in terms of output yields, head, work load energy requirements (such as generators) to perform the task as anticipated in these specifications and the contract generally.
- ii. 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 in capacity, the Client shall have the right to call upon the Contractor to put such equipment in good order within seven days or alternatively to remove such plant and replace it with additional plant or equipment which the Client considers necessary to meet the requirements of the Contract. In the event that this requirement of the Contract is not satisfied, the Client reserves the right to terminate the Contract immediately.
- iii. No extra payment shall be made for the Contractor's change of drilling equipment, labour or other equipment required to complete the Works specified, nor for any incidentals thereto, the cost being deemed to be included in the schedule of rates.

3 SITE SELECTION

The Contractor upon arrival in the Kidepo Valley National Park will meet a representative of Uganda Wildlife Authority

The Contractor shall receive from client the list of proposed locations sited by the geophysical surveying team. Contractor upon visiting these locations will determine the road conditions for accessibility of the drilling rig and other heavy equipment. The Contractor will receive from client a list of additional reserve locations by order of priority as replacements for any dry or unsuccessful boreholes. Any changes or alternative sites will be in consultation with Client and designated representatives.

Special care must be taken to ensure that the sites chosen are at least 30 meters away from toilet pits or any other sources of pollution such as grave yard, stagnant pools of dirty water or animal pens.

The Contractor will review all sites identified by the siting team, prepare a Drilling Work Plan and communicate it in writing to the Client with a **sketch map** showing the rig movement and their distances between the consecutive drilling sites and Gantt chart to show the completion plan for all works.

Sites selected will consider the rainy season and accessibility to heavy drilling rigs and support vehicles. If the Contractor considers improvements are required for any reason to enable him carry out the Works, he shall:

- Request permission from the client
- Make the improvements at his own expense.

In the event that improvement is not feasible, and access is still not possible, then the contractor should notify in writing to the client and seek permission to replace the location from the reserve list.

3.1 Borehole Construction

A typical borehole section is shown in **Annex: 7**. Basic methods of drilling are indicated below as a basic guide, mostly to maintain a few key dimensional specifications.

3.2 Drilling Methods:

- i. The preferred method of drilling in consolidated compact formations is rotary percussion with air and/or foam flush. Boreholes will be drilled with 8" then followed by 6 7/8-inch drill bits and reamed with a minimum diameter of 10 5/8 inches for sanitary protection or to allow for lowering temporary casings.
- ii. In unconsolidated loose, unstable, collapsing formations, rotary with appropriate drilling stabilizer will be used. In such a case the drilling diameters will be telescopic starting with diameter large enough to lower temporary casing in upper collapsing formations and continue drilling with a final minimum diameter of 6 7/8-inch bit. The first layers from the surface are always soft and usually unconsolidated. This calls for ways of stabilising the hole to prevent the walls from collapsing hence using the temporary casings. Once a firm (competent) layer has been reached, installation of temporary casings stops and

a smaller diameter drilling bit can be used to drill. If other chemical fluids or solids are used to arrest collapsing of formations, the Contractor has to use proper borehole development and cleaning methods to ensure the use of borehole water is safe for drinking purposes. The Contractor will use such fluids or solids with the agreement of the Client. Boreholes will be constructed with UPVC casings, screens and sand trap. The Contractor will decide appropriate lengths of slotted screen in the aquifer intervals in concert with the site supervisor. However, the contractor is solely responsible for the design of the borehole and the outcome thereof. All cost of using proper drilling fluids and solids is deemed included in the rate per meter quoted. No additional payments will be made by client.

3.3 Borehole Depth:

Boreholes shall be drilled to such depths as to penetrate below the shallow water table aquifers and tap the first potential deeper aquifer or aquifers in confined/semi-confined conditions with a minimum discharge of 500 litres per hour to sustain continuous pump testing for 3 hours to ensure reliable operation of hand pumps fitted on them. The depth to be drilled should be at least 75 metres below surface and at least ten meters below the main aquifer to provide proper installation of a pump and to provide a sand trap of 3 meters. If the discharge is less than 500 litres per hour, a decision to abandon the borehole or continue to drill deeper will be at the discretion of the Contractor; providing the maximum recommended depth has not been achieved.

If during the drilling, and before the minimum depth is achieved, the contractor is convinced that, the airlift yield surpasses the minimum yield and is above 1,000 litres per hour; the contractor on consultation with the site supervisor can elect to stop drilling proving, he drills at least ten meters below the main water strike; and providing he guarantees the minimum yield during well development and test pumping.

3.4 Borehole Diameter:

- I. Boreholes will be drilled with telescopic diameters.
- II. The first 6 meters from the surface will have concrete grouting for sanitary protection. For this, the borehole will be reamed to a minimum diameter of 9" or 10 5/8" inches and concrete grouting placed in the annular space between the casing and open borehole wall.
- III. The boreholes will be drilled with 8" then 6 7/8-inch (174.63mm) bit in the hard rock. The reaming diameter will be based on the type of temporary casing the contractor will use and not less than 9 inches to install Class 10 UPVC casing of 140mm outside diameter (5.5" outside diameter and 5" inner diameter) for the total depth of the borehole. (Bottom design/shallow well design/ full casing)
- IV. The contractor must take into account the depths he has to drill and lower temporary casing to complete the drilling. This cost must be built in the quoted unit cost for drilling.
- V. The client will not be responsible for any loss of temporary casing which the contractor is unable to pull out or lost due to snapping or breaking from the completed boreholes.

3.5 Screen:

- I. The Contractor will use factory-made Class 10 UPVC slotted screens, the slot size not exceeding 1mm wide, and screen length (average 2.85m – 3.05m), and total length per borehole depending on the aquifer materials and aquifer thickness. The Contractor will take sole responsibility of designing the well assembly and placing screen and casing at appropriate depths to match the positioning of the aquifer(s).
- II. Slotted screens should be of DIN 4925/8061 or equivalent approved by international standards and have the following dimensional specifications: UPVC casing pipe, Class 10, drinking water standards, nontoxic and in standard lengths of three (3) meters, Nominal diameter of 125mm, OD 140mm, flush jointed, male female trapezoidal threads, slot width 0.75 mm and not more than 1mm, and open area as percentage of internal surface area 9.26% per linear meter. Depending on the aquifer, the Contractor may choose an appropriate slot width other than 0.75mm.
- III. All boreholes shall be vertical, shall be drilled and cased straight, and all casings/screens shall be set round, plumb and true to line. If required by the Supervisor, the Contractor will make a verticality test during and after drilling by approved methods and at his own expense to demonstrate that the departure from the vertical does not exceed 3mm per 1,000mm between ground level and the bottom of the borehole. If this departure is exceeded, the Contractor shall make the necessary corrections to the approval of the Supervisor, without additional payment. If the error cannot be corrected, then drilling shall cease, and a new borehole shall be drilled at a position nearby, indicated by the Supervisor. The abandoned borehole shall be backfilled and/or capped by methods approved by the Supervisor. No payment will be made for the re-drilling, the sealing/backfilling of the abandoned borehole, or for moving to the new site. Any materials (i.e., casing, screens, gravel pack, cement, etc.) lost in the abandoned borehole will be to the Contractors cost.

3.6 Casing Pipe and Sand Trap:

- I. Casing pipe should be of DIN 4925/8061 or equivalent approved by UNBS or international standards, and have the following dimensional specifications: UPVC Class 10, drinking water standards, nontoxic and in standard lengths of three (3) meters in length, internal diameter 125mm, outer diameter 140mm, WT 7.5mm, flush jointed for internal and external diameter, male /female trapezoidal threads and in lengths of 3 meters average.
- II. The boreholes will be cased to the bottom. The level below ground level that the casing will stop must be approved in writing by the drilling supervisor for the client. The threads both male and female are properly cleaned with a clean brush and cloth before they are joined.
- III. The Contractor will take all necessary precautions during the transportation and storage of casing pipes from their storage to drilling sites to prevent distortions, ending or deformation of the pipe that could result in eccentricity along the length of the pipe.

- IV. A maximum of 3-meter length of sand trap will be part of the well design when boreholes are cased to the bottom. The sand trap will be from UPVC casing pipe with specifications described above, fitted to the end of last screen and bottom end with an end-cap. The end cap is glued with appropriate solvent cement or solutions as recommended by the UPVC manufacturer. Note that the joint sections are properly cleaned with cleaning fluids and recommended time given for the joint to set firmly before lowering into the borehole.

3.7 Gravel Packing and Grouting:

- I. The annular space between the casing and borehole wall is filled with filter packing materials (approved gravel), ensuring that gravel column extends up to a minimum of 3m above the top most screen in the well. The level of gravel must be measured at intervals during well development, and where necessary, extra gravel added to achieve the designed depth. The gravel packing material size, should preferably be non-disintegrating rounded silica materials, ranging between 2-6mm in diameter. If the supervisor on site feels the gravel is not well sorted, the contractor will sieve it on site, using a mesh of retaining 2mm and another retaining more than 6mm. Gravel packing material will be stored in a way so as to avoid contamination or rain-washing finer materials. Iron and Calcareous grains will not be included in the gravel pack materials.
- II. The contractor will be required to sieve and wash gravels if found to be supplied not to the required size and dirty.
- III. Gravel packing is carried out as continuous feed operations done usually by two people filling uniformly around the circumference of the pipe. It is advisable to add some water with a pipe so that the gravel flows down. If the gravel gets inside the temporary casing, the casing is slowly pulled out and gentle well development is done to allow gravel to settle properly to a height of 3 meters above the top most screen. More gravel is added with development if the gravel settles down.
- IV. Backfilling and grouting is done when the minimum acceptable yield of 500 litres/hour is confirmed by development. The borehole cuttings or clayey soils are back filled up to 6 meters below the ground surface.
- V. The grouting is done with a concrete mix in the ratio of 1:2:4 of cement, sand, aggregate respectively. The aggregate size should be not more than 6mm.

4 BOREHOLE DEVELOPMENT:

On completion of drilling, the Contractor will choose a suitable and appropriate borehole development method. The borehole shall be developed for a period of at least two hours in order to obtain a maximum yield of water that is free of suspended matter. Development shall be carried out by airlift pumping and surging, jetting and block surging, or other techniques the contractor feels is 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 Contractor

should provide the equipment required for verticality testing as described in Directorate of Water Development regulations. Development will be for a minimum period of 2 hours, until water is clear, and free of any suspended solids or cuttings or drilling fluids or colloidal matter seen by the eye to the satisfaction of the supervisor on site.

5 PUMPING AND RECOVERY TEST:

- I. A pumping test is required on a routine basis for each borehole completed to;
 - Confirm that the well meets the minimum yield requirements set for the intended pump to be installed
 - Establish the safe installation depth of the (hand) pump
 - Determine the (basic) borehole aquifer characteristics
 - Allow for sampling for water quality analysis to ascertain if the water is safe for human consumption.

The Contractor will estimate the discharge from the air lifting rates or blow test during borehole development. Based on the estimated discharge, the Contractor will certify the borehole as either "successful" or "lost". For successful boreholes, the Contractor will undertake a three-hour constant rate test as follows:

- II. All wells to be test pumped for 3 hours at a constant rate. Boreholes with drilling airlift yields between 500 and 800 litres per hour shall be test pumped at 500 litres per hour. Boreholes with airlift/driller's yield above 800 litres per hour will be test pumped at 1,000 litres per hour for 3hours constant.
- III. The contractor and supervisor should avoid the temptation to subject the boreholes at pumping yields above the thresholds above; as that would result in a high drawdown, leading to deep hand pump installation depths, that ensure heavy pumping and high O&M costs for the users in replacement of hand pump materials at a later stage. Unless a borehole is out rightly considered a production well, then, a test prescribed for production wells would be planned and executed.
- IV. Recovery test will be for 1.5 hours or such time when the three is at least recovery of 90% of the static water level noted at the start of the pump test. The pump test data and the results of pump test is presented in the standard form attached (Annex- 8).
- V. Readings of flow and water level shall be taken at the intervals defined on the test pumping (aquifer data collection) form. For accurate measurement, an electrical/ sonic water level indicator with graduated tape for taking water level readings should be utilized. Recovery readings shall be taken until 90% of the created drawdown is achieved, or for 1.5 hours (which-ever comes first), during which period pumping equipment shall not be removed from the borehole; but pumping shall have stopped.

6 WATER QUALITY TESTING:

- I. The contractor shall, make sampling and quality analysis of water from every borehole considered yielding or successful.
- II. The water quality test should be conducted at a competent testing laboratory that is authorized by the client.
- III. The parameters to be tested are given in table below and standards will be according to the Water Quality Assurance Plan (WQAP) and UNBS guidelines for drinking water quality. All tests required by UNBS/MOWE are the responsibility of

the driller even if not listed herein.

- IV. Water samples for chemical analysis should be collected at the end of the test pumping process and analysed at the approved laboratory at the earliest possible time to facilitate timely handing over of the borehole for use by the community.
- V. Thus, the pump handle should only be fitted after acceptable chemical analysis results. Samples for biological testing will be collected later in suitable batches so as to meet the time limit of 48 hours between collecting and analysis in the laboratory. These particular samples should follow a strict sampling and analysis plan as guided by the laboratory.

7 Pump installations (Riser pipes and connecting rods)

- I. All the sources will be installed using stainless steel riser pipes and stainless-steel connecting rods materials to ensure compliance with UNBS standards
- II. 32mm or 1 1/4" stainless steel riser pipes in 3m lengths with O ring and welded seamless sockets in AISI 304. 1pc Nipple adapter stainless steel AISI 316; or equivalent

Table 1: showing parameters to be tested

Biological	Physical	Chemical
Faecal coliforms	Colour	Arsenic
Total coliforms	Odour	Fluoride
E. coli	Taste	Manganese
Shigella in 100mL	Turbidity	Total Dissolved Solids
Salmonella in 100mL	PH value	Copper
	Electric Conductivity	Nitrate
		Sulphate
		Chloride
		Bi-Carbonate
		Magnesium
		Calcium
		Total Suspended Solids
		Alkalinity: Total as CaCO ₃
		Hardness: Total as CaCO ₃
		Iron total
		Nitrite (as NO ₂)
		Lead (as Pb)
		Ammonia (as NH ₃)
		Aluminium (as Al ⁺⁺⁺)
		Total Dissolved Solids

8 SAMPLING AND DRILL TIME LOGS:

Representative samples of the strata intersected shall be collected every one meter or less depending on the change of geological formation. For collection, the Contractor shall cease drilling, circulate all cuttings to the surface, resume drilling and collect the cuttings then brought to the surface. The Contractor shall take every possible precaution to guard against sample contamination due to poor circulation, bore hole erosion, or caving. Cutting samples shall be bagged, labelled with borehole depth at time of collection, and stored in a position where they will not be contaminated by site conditions or drilling operations. The Contractor shall supply strong, transparent indelible labels as required. The driller in-charge will also record the drill time logs/penetration rate of each rod or at every three-meter interval. A sample of lithological log with drill time log is shown in Annex – 8. The driller in-charge will also record the drill time logs/penetration rate of each rod or at every three-meter interval.

9 CHLORINATION AFTER BOREHOLE COMPLETION:

Each successful borehole must be chlorinated following completion drilling operations. The Contractor will decide on the concentration of chlorine based on the volume of water in the borehole. It is recommended to use between 150 to 200 grams of bleaching powder per cubic meter of water for safe disinfection. The volume should be calculated based on casing storage column (i.e static water level to bottom of well). Mix 300 grams of bleaching powder thoroughly in 15 litres of water in a bucket and pour the solution into the borehole

10 PROTECTION:

Each successful borehole must be chlorinated following completion of drilling operations. The Contractor will decide on the concentration of chlorine based on the volume of water in the borehole.

After successful completion of drilling, casing and testing; head-works will be constructed in line with the guidelines given in the **Installation and Maintenance Manual for the India Mark II Hand pump**. Please find this in Volume 3.4 Installation and Maintenance Manual for the India Mark II Hand Pump.

11 ABANDONMENT.

The Client shall have the right at any time during the progress of the Works to order the abandonment of the borehole. This situation may arise with time within the Guarantee period because of one or more constructional defects such as ruptured / cracked casing, sections of boreholes collapsed, heavy silting closing the screen, screen choked/clogged; lowering the discharge, or poor siting of borehole with no potential sustainable aquifers, drilling up to insufficient depths to tap potential sustainable aquifer. In the above case the Contractor shall either improve the discharge by appropriate well development methods or if the dynamic water level is less than 40m, lower the pump inlet with additional riser pipes and connecting rods. In the case of any remedial works not being effective the Contractor shall drill a new borehole at an alternative site mutually agreed with the Water Committee and the Client. If after investigations, the Contractor feels that there are no possibilities of drilling a successful borehole in the village/ community, then the Contractor can move to a new location. This should, however, be after two failed attempts to drill the

borehole in the same location.

If the contractor is unable to remove the defects, abandoned due to any other reason then, the borehole is classified as “Dry or low yield” and contractor has to refund the client. The Contractor shall thereupon remove the drilling rig, withdraw any casing and screen and salvage all such materials as the contractor may afford, and shall fill and leave the borehole to the satisfaction of the Client. In such case all works done and materials used will be paid by client.

12 “LOST” (UNSUCCESSFUL) BOREHOLES:

“Lost” boreholes are either “dry” boreholes or “uncompleted” boreholes.

13 DRY OR LOW-YIELD BOREHOLES:

Dry or low yield boreholes are defined as:

- a. A borehole having no water bearing zones/aquifers
- b. A Borehole that has insufficient discharge (less than 500 litres/hour) for 3 hours of continuous pumping test
- c. A borehole with stabilized Dynamic Water Level below 45 meters at minimum acceptable discharge of 500 litres/hour

14 UNCOMPLETED OR TECHNICALLY FAILED BOREHOLES:

- I. For any reasons, contractor is unable to continue drilling and complete the construction of borehole then this borehole is deemed to be an “uncompleted or technical failure borehole “.
- II. In case of “uncompleted” boreholes, no payment shall be made for that borehole either for drilling or materials that cannot be salvaged, and the rig’s unproductive time spent. If the Contractor chooses to deviate from standard procedure and the agreed method of drilling and wishes to adopt any other procedure or techniques that involves any additional cost and time required it will be done so entirely at the Contractor’s own risk and cost.
- III. A borehole that has failed verticality test

15 TEST OF ACCEPTABILITY AND REPORTS:

Subject to meeting the requirements of the maintenance period, the borehole shall be accepted for payment on presentation of the following reports at schedules shown in the table below and sample of the formats given in the annexes:

NAME	DESCRIPTION	FREQUENCY
1.Sketch map showing the drilling plan (see annex 1)	A table showing the following: location name, borehole number, distance in kilometres from the last drilling location along with a sketch map showing the above information and sequence in which the drilling will progress i.e. route of movement of the rig (see Annex -1)	Once – before the starting of drilling operations
2.Strata log, penetration rate, Log and location of main strikes (see Annex-8)	An accurate record of strata passed through and the depths at which strata were intercepted; also, progressive measured airlifted yields after reaching water. An accurate record of the penetration rates achieved in minutes for each meter drilled, together with type, size and grade of bit.	Recorded daily as drilling progresses, Provided as a well log per borehole, including an individual well design for each borehole. Submitted to client together with invoices for payment.
	An accurate record of time spent each day on different phases of drilling, to include rig down time, with causes.	
	A record of depth at which the water zones were struck during the drilling. Information can be combined with strata log and penetration log.	
	A detailed meter by meter well lithological log, describing; colour, texture, cuttings size, shape, etc in a step-by-step process from the start to the end of drilling	
Pumping Test data (see annex-9) and recovery test results (See annex 10)	A detail report on the pump test, including the data of draw down with time; yield measurements (time taken to fill the measuring container at every 10min of pumping from start) and recover test, specific recommendations on hand pump installation.	Once, recorded during pumping test Submitted to client with Invoices for payment.

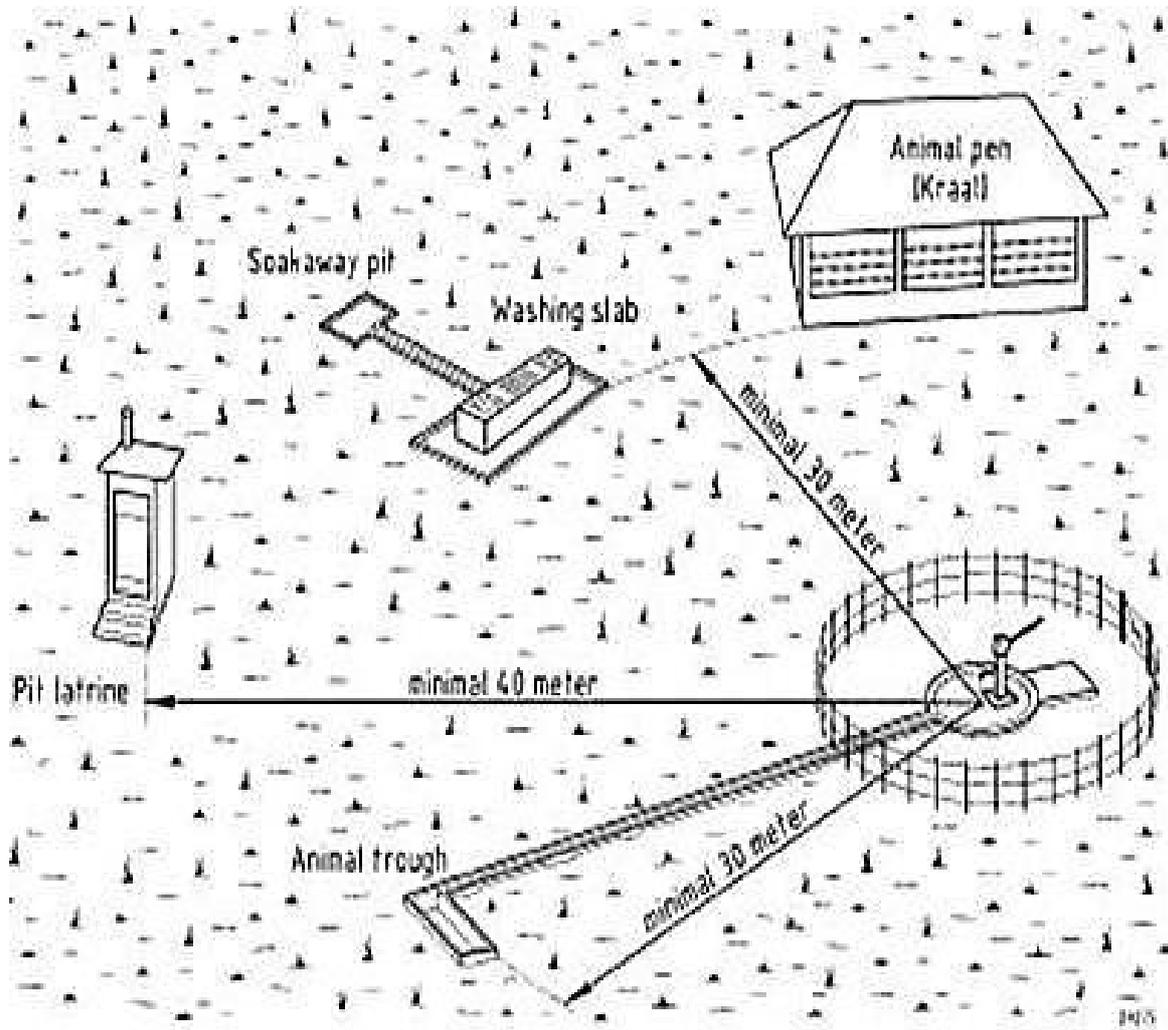
NAME	DESCRIPTION	FREQUENCY
Construction log (See Annex-7)	An accurate record and a drawing / figure showing the details of well construction- position of all casings, slotted casings (screens), sand trap, gravel pack, end cap placed in the borehole, their quantities, hand pump installation- position of cylinder, number of connecting rods and riser pipes.	Recorded for each borehole after completing borehole construction Submitted to client with Invoices for payment.
5. Invoices for works done.	Invoices in same form in which rate schedule were quoted and a summary sheet for all invoices	Dependent on the agreed payment schedule
6. Certificate of completion	A certificate of Completion &. Acceptance of pump facility constructed from Client staff. During the installation of every hand pump, a community represented should witness the installation and sign on the hand pump installation certificate to be provided by the contractor or supervisor	Once after the inspection of pump facility by Client staff and submitted to client with the invoices.

15.2 The Contractor is expected to submit three (3) spiral-bonded copies of the above reports and a summary in the beginning for each instalment of payment.

ANNEX 1: Locations for drilling of Boreholes with Distances Between locations

Table showing Locations for drilling of Boreholes with Distances Between locations. See attached siting report

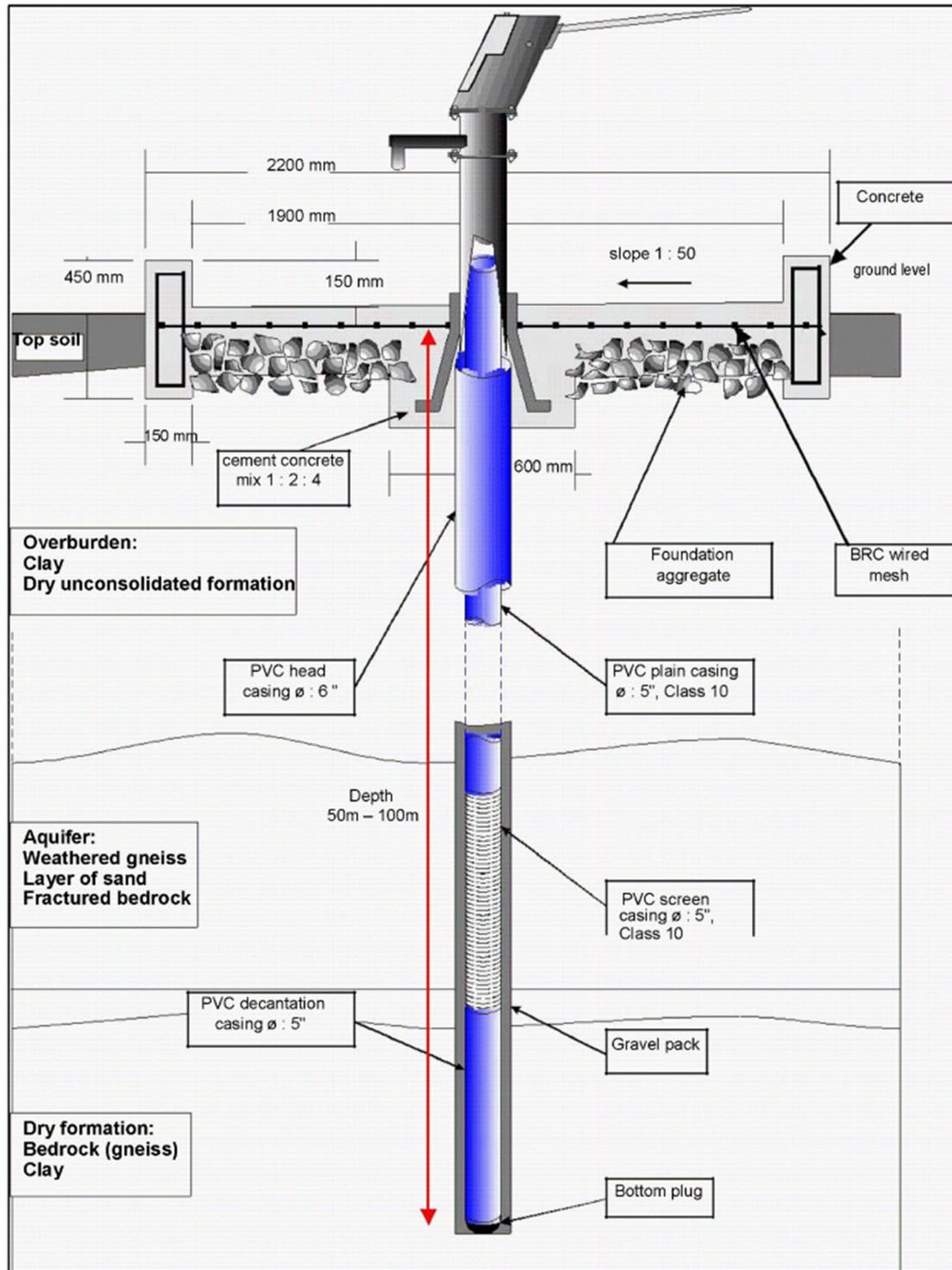
ANNEX 2: Figure showing the distances from sources of pollution to be observed for site selection in constructing a water point



ANNEX 3: An example of drilling program-to be adopted at time of bidding.

No	Description of Activity	Months	2020																			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
			Responsible																			
	Initial road survey determining mobility of GPS rigs,																					
1	GPS Distances. reading,	Contractor																				
2	Technical verification of sites(Geophysical surveys)																					
3	Borehole Drilling Work																					
4	Pumping Test																					
5	Pump Installation.																					
6	Apron, spilway and soak construction																					
7	Cleaning the site and handing over																					

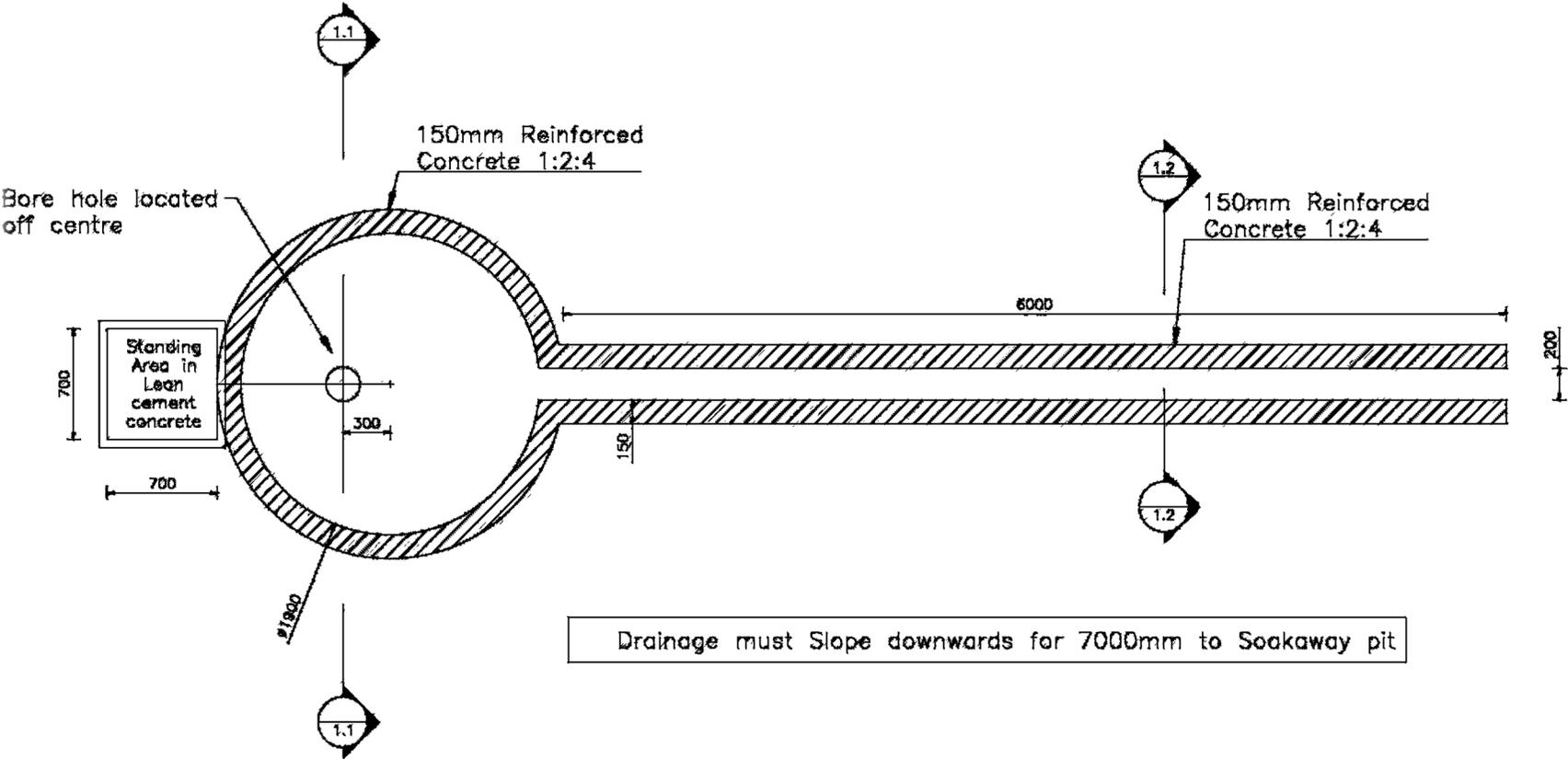
ANNEX 4: Schematic diagram representing a completed borehole



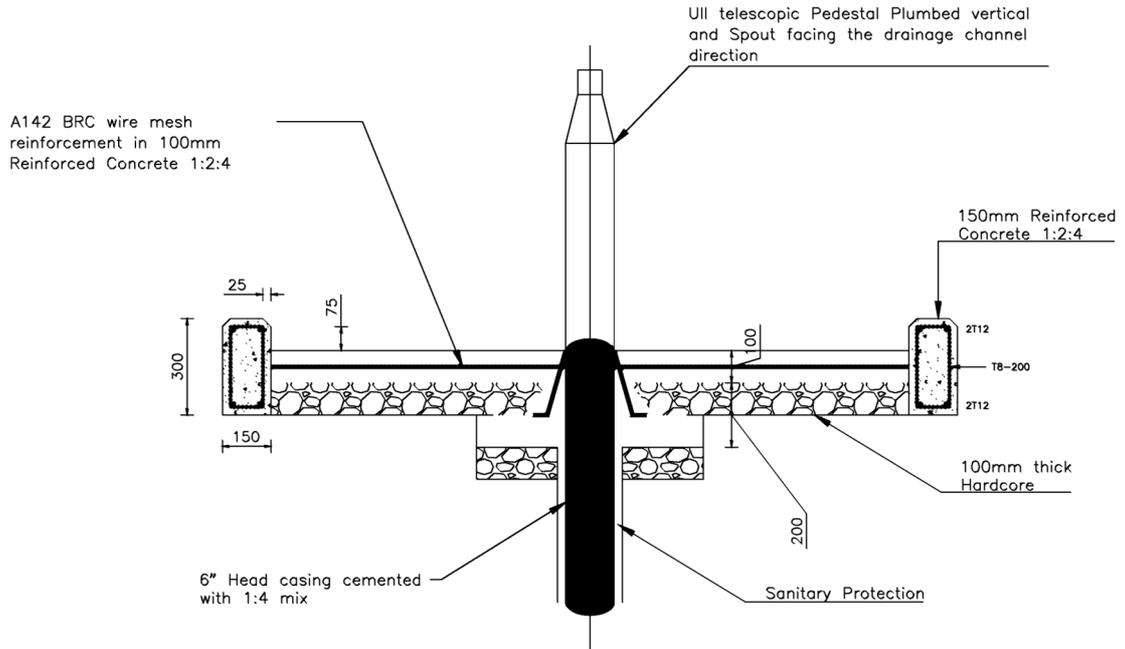
Note: PVC casing & screen Nominal diameters are 5 inches as shown in the figure

ANNEX 5: Borehole slab /plat form

PLAN VIEW

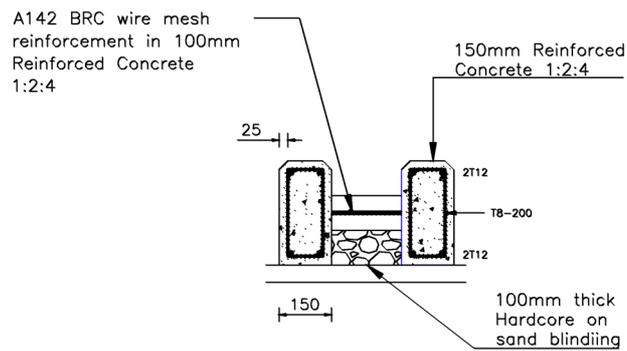


SECTION 1-1



Section 1-1 through the Apron construction for installing Hand pumps

SECTION 2-2



Section 2-2 through the channel

ANNEX 6: An example of a well log – Field data collection forms are attached

Borehole completion data						Drilling Contract No.:				
DWD ref. no.	DWD	xxxx	Drilled at VES		xxx	Company reference number:				
Final Depth (m)	82.00	District	xxxx		Altitude		xxxx m amsl			
Airlift yield (m ³ /hr)	10.20	Sub-County	xxxx		GPS E		xxxx UTM Grid			
SWL (m bgl)	xxxx	Parish	xxxx		GPS N		xxxx 36N			
Date started	xxxxx	Date completed	xxxx		Drilling Unit	xxxxxx	VES			
Drill pipe	Depth (m bgl)	Penetration time (min)	Geology			Aquifer type	WSL (m bgl)	Yield (l/hr)	Design	Depth (m bgl)
			Type	Size and color and other details						
1	4.25	4	Clay	Reddish clay					<p>The diagram illustrates the well's construction from the surface down to 81.94m. Key components include: Inert backfill at the top; Bentonite sanitary seal; Clay seal; 5" casings; End of 254mm hole @34.6m; Filter pack; 5" Screens; and End of 203.4mm hole @81.94m.</p>	
2	8.82	3	Clay	Reddish clay						
3	13.39	6	Clay	Reddish clay						
4	17.96	7	Clay	Reddish clay						
5	22.53	7	Clay	Reddish clay						
6	27.10	8	Clay	Reddish clay		F	27.00	2,000		
7	31.67	7	Granite	Brackish coarse granite rocks						
8	36.24	10	Granite	Brackish coarse granite rocks						
9	40.81	17	Granite	Brackish coarse granite rocks						
10	45.38	20	Granite	Coarse greyish granite		F	45.00	4,000		
11	49.95	23	Granite	Coarse greyish granite						
12	54.52	22	Granite	Coarse greyish granite		F	53.00	2,000		
13	59.09	22	Granite	Coarse greyish granite						
14	63.66	22	Granite	Blackish fresh granite		F	62.00	2,000		
15	68.23	26	Granite	Blackish fresh granite						
16	72.80	29	Granite	Blackish fine granite						
17	77.37	29	Granite	Blackish fine granite						
18	81.94	33	Granite	Blackish fine granite						
								Total airlift yield:	10,200	
								Main water strike:	38.00	

11. Installation

- i. Installation of U2 deep well hand pump super structure incl. pedestal, water tank, pump head and reinforced concrete platform (concrete mix 1:2:4) and 6m long drainage channel.
- ii. Installation of original 1¼" stainless steel riser pipes 304 grade (in 3m lengths).
- iii. Installation of stainless-steel connecting rods (in 3m lengths).
- iv. Installation of U2 Cylinder unit complete.
- v. Construction of complete 1.5 x 1.5m deep soak pit
- vi. Install the pump after 3 days.
- vii. Pump several times until the water is clear and there is no fine sand or materials.
- viii. Properly installed hand pumps should fill a 20 litres bucket in 20- 25 full strokes. If it takes more than 30 strokes, then something is wrong with the installation of hand pump. The full stroke of the pump should be ideally 21-23 cms.

12. Fencing of Water Source

In addition to constructing a slab, a fence will be erected around the water point to prevent animals from accessing the water source. This can be done immediately after the construction of the well is finished, and should give enough space to operate the handpump.