Technical SPECIFICATIONS EXTRA DEEP BOREHOLE DRILLING

Annex 3: Drilling log sheet

[NAME OF ORGANIZATION]			DRILLING LOG SHEET		Page of	
[PROJECT/CONTRACT]			CONTRACTOR/DRILLER:			
Borehole No.:			Location/Co-ordinates:		Elevation:	
Drill machine:			Mud/Air:		Supervisor:	
Start date:			Completion date:		Completion depth:	
Borehole Data			Drilling penetration rate (units:)	Marsh funnel viscosity (sec)	Casing, screens, filter gravel pack installed	Other information or remarks
Depth (m, ft)	Lithology from samples	Water strikes				

Annex 2: Test pumping data sheet Template

[NAME OF ORGANIZATION]			TEP DRAWDOWN TEST DATA SHEET						
[PROJECT/CONTRACT]			CONTRACTOR:						
Borehole No.:			Location/Co-ordinates:				Elevation:		
Borehole New/Rehabilitated			Borehole Depth:				Static Water Level:		
Test Pump Type:			Pump Inlet Depth:				Test Datum:		
Existing Pump:			Test Supervisor:				Test Date:		
Pumping Time (min.)	STEP 1 (1 hour) Drawdown (m)	Discharge (units)	STEP 2 (1 hour) Drawdown (m)	Discharge (units)	STEP 3 (1 hour) Drawdown (m)	Discharge (units)	STEP 4 (1 hour) Drawdown (m)	Discharge (units)	Recovery (Residual Drawdown) (m)
0.5									
1									
1.5									
2									
2.5									
3									
4									
5									
6									
7									
8									
9									
10									
12									
15									
20									
25									
30									
40									
50									
60									
70									
80									
90									
100									
120									
Remarks:									

For recovery (residual drawdown) measurements after pumping stops, use same time intervals, continuing with readings every 100 minutes after 2800 until water level has recovered to within 20 centimeters of original static water level.

Annex 1: Basic drilling contract: Clauses and specifications

A. General Clauses

A.1 The purpose of the contract is the construction of 12 extra deep boreholes for potable water supplies for the community in Greater Kubal Gumurruk County

The Contractor will carry out the specified drilling works and provide proper machinery, implements, tools, materials, and labour for due construction of the boreholes, their development and test pumping. He will also provide the casings, screens, and gravel filter pack materials according to the quality specifications given hereunder.

A.2

The Client will provide all available information about the surface and hydrogeological conditions at each drilling site. This information does not hold the Client responsible for local variations in conditions at specific drilling sites or for particular problems the Contractor may face while carrying out his work.

A.3

The Client will indicate the drilling sites and provide the required permits for access to land where the contract is to be carried out.

The Contractor will be responsible for all damages occurring outside the allocated land.

The Contractor will clear all debris of any kind, and leave the land, as far as it is possible, in its original condition once the borehole has been completed, developed, and tested.

A.4

If the Contractor is not able to complete the drilling or has to abandon the borehole owing to loss of tools or any other accident or contingency, he should remove the casing or drive pipes already placed in the hole and refill it with clay or concrete, at his own expense. All material extracted from such holes, after back-filling them, will be considered the property of the Contractor. In this case the Client will not pay for any of the work carried out, and will authorize in advance the drilling of a new hole, at a site near the abandoned one.

B. Technical Specifications

B.1 Boreholes

B.1.1 Information concerning each borehole

The Contractor will supply a detailed borehole log, in which all relevant information on drilling rate, well casings, and other construction operations will be accurately recorded.

The Contractor will also annotate all information pertaining to the appearance of water strikes and aquifers, types of strata found, and formation sampling details.

B.1.2 Casing and diameters

The drilling of each hole will be carried out according to the requirements of these specifications, using the proper drilling tools, drive pipes, casing pipes, gravel packs, and sanitary protection, based on the real characteristics of the aquifer formation(s). The casing pipe and sanitary protection (seals) should isolate the aquifers from other formations considered unsuitable for production of potable water.

The borehole design is to be authorized by the Client (or the Client's representative on site) before casing pipes and screens are installed in the well.

B.1.3 Pipes, screens, and artificial gravel packs

The Contractor will supply all pipes, screen filters, and fittings for the proper casing of the wells at the agreed price.

An artificial, properly graded gravel pack will be placed in the annular space between the borehole wall and the outer face of the casing/screen. Proper techniques should be used for the accurate placing of this pack on site. The gravel to be used should be clean, and well rounded. The grains should be hard and of alluvial origin, and in size between 0.5 and 2.5 centimetres diameter. This gravel must be approved by the Client.

B.1.4 Drilling equipment and depth of drilling

The Contractor will use drilling equipment capable of drilling down to the required depths. The use of cable tool, rotary, or down-the-hole hammer (air percussion) rigs is acceptable. Any borehole depths indicated to the Contractor prior to drilling should be regarded as tentative and for guidance only.

If the actual characteristics of the boreholes to be drilled justify any change in these specifications, the Contractor will request the authorization of the Client for such changes

to be made. These communications will be made verbally and shall be correctly recorded by the Client.

Once changes in borehole depth have been authorized by the Client, a proper price adjustment will be made in accordance with the final depth of the borehole and the unit price rendered by the Contractor in his original proposal.

B.2 Borehole completion and test pumping

B.2.1 Pumping tests

Once the borehole construction is completed, the well will be developed by treatment with suitable mud dispersant additives (if required) and hydraulic surging (by means of a surging piston/block or compressed air). Immediately after these operations are completed, and the borehole water is certified clean by the Client, the pumping unit can be introduced into the well.

The Contractor will provide a test pumping unit capable of discharging 50 per cent more water, at the borehole's pumping water level, than the maximum yield indicated for each borehole.

The Contractor will communicate (……days in advance) the date the pumping test is to be carried out. Test pumping of the borehole is to be performed in accordance with 2.2.1.1.

B.2.1.1 The pumping test

The test will consist of continuously pumping the borehole at the maximum yield specified (or at any other previously defined rate(s), according to the results of the drilling work) between the Contractor and the Client. The duration of this test will be ……hours. Measurement of dynamic water levels will be performed according to the logarithmic time-scale schedule normally used for test pumping water wells.

B.2.1.2 Other specifications

The Contractor will remove all pumped water in such a way that no surface ponding occurs at distances less than 100 metres from the borehole. The Contractor will provide all the necessary materials for this purpose.

The Contractor will provide all necessary equipment (such as weirs, pipes, or meters) for the proper measurement of discharge rates and water levels.

B.2.2 Borehole yield

After the pumping tests have been carried out, the Client will decide the recommended production yield for each borehole, according to the test results, appropriate hydrogeological techniques, and the actual needs.

B.3 Borehole verticality (plumbness) and alignment

B.3.1 Tests

The borehole will be tested for plumbness and alignment by means of a 12-metre-long, perfectly straight, steel rod or pipe that will be introduced along the whole well. The external diameter of this will, at the most, be 13 millimetres less than the well casing's inside diameter. This item will be supplied by the Contractor.

B.3.2 Minimum requirements

The test item, described in B.3.1, should pass easily through the whole borehole, or through the main section of casing that will contain the production pump and rising main. Loss of plumbness of the well axis should never be more than two-thirds of the inside diameter of casing. If these minimum requirements are not met in the borehole, the Contractor will, if possible, correct the defects. Otherwise, the Client is at liberty to reject the well and no payments will be made for its drilling and completion. This check should be made before or after test pumping of the borehole.

B.4 Protection of water quality, disinfection, and sampling

B.4.1 Contractor responsibility

The Contractor will take utmost care to avoid physical, chemical, or bacterial contamination of the well water during the construction process. Where water is polluted owing to the Contractor's neglect, he will be obliged to carry out all necessary remedial operations, at his own cost, in order to remove such pollution from the well.

B.4.2 Well sterilization

Once the borehole has been completed and tested, the Contractor will disinfect the well with a chlorine solution yielding at least 50 milligrams/litre of active chlorine in all parts of the well.

The chlorine solution for this purpose may be prepared by dissolving calcium hypochlorite, sodium hypochlorite, or gaseous chlorine, in water. The chlorine solution should stay in the borehole for at least four hours, at the specified concentration.

B.4.3 Formation samples

The Contractor will keep a complete record of the formation samples taken during the drilling operations, in properly packed and identified sample bags, and will make these available to the Client upon his request.

The Contractor will take at least one sample every three meters of drilling, unless a change in geological formations is observed by the driller. In such cases, additional samples should be taken. The minimum weight of each sample should be 500 grams.

For each sample not taken, the Contractor will be fined a penalty amounting to 1% of the total value of the borehole, and this will be deducted from the final payment. If the total amount of samples missed is more than 15% of the specified number, the borehole should be started again, and the Client will not make any payments for the work already done.

B.4.4 Water samples

The Contractor will take two water samples for laboratory analysis, after completion of the long-duration (constant discharge) pumping test. One sample will be used for physical and chemical analysis, and this should be placed in a clean and properly sealed plastic or glass container. Its volume should not be less than five litres. The second sample will be used in a bacteriological analysis. It should be collected in triplicate, in sterilized, properly sealed, and protected containers. The volume of such containers should not be less than 100 millilitres. The samples will be handed to the Client as soon as they have been collected.

B.4.5 Sand particle content in pumped water

The water drawn out of the borehole will be acceptable if it has a sand particle content of less than three grams per cubic meter. Should this limit be exceeded, the Contractor will make all necessary adjustments to the well structure, at his own expense, in order to meet this specification.

B.5 Finishing works

B.5.1 Temporary cap

The Contractor will pay close attention to the due protection of the borehole against entrance of water or other pollutants while drilling or after completion of the borehole. For this purpose, he will provide a temporary cover or cap to be placed atop the borehole casing at any time the drilling rig is not in operation. This cover will also be placed after the borehole has been completed.

B.5.2 Sanitary seal

All the boreholes that have been successfully completed and tested should have proper sanitary seal protection built of concrete.

This protection will be placed a minimum of two meters below the ground to 0.25 meter above the ground and will occupy all the annular space between the borehole wall and the outside of the casing/screen.

B.6 Borehole drawing x-section