

NOTE ON BOREHOLE REHABILITATION

1. Assessment / situation analysis of the boreholes

WE will request a list of villages with boreholes to be rehabilitated in each Sub County. It should be noted that rehabilitation of low yielding boreholes is not likely to lead to higher yields so when allocating boreholes for rehabilitation the client should try to get information about the yield from the borehole records and avoid allocating boreholes that are not functioning because of low yields. It is recommended to allocate and assess approximately 20% more boreholes than the originally planned number of boreholes for rehabilitation out of which the best boreholes will be rehabilitated. The final number of boreholes to be rehabilitated depends on the budget and the costs of the activities carried out for each borehole. Our staff can closely follow the budget and will make sure the budget is used effectively.

We shall then deploy a team headed by an assistant water engineer to assess the condition of the boreholes. For each borehole visited during this phase, the following will be done:

1. Check status of platforms, drainage channel, soak away pits and note the well identification numbers (if any).
2. Dismantle the pump head and also trip out all the pump parts (riser pipes, rods, connectors and cylinder) where possible, to assess their condition and check whether the borehole is backfilled (casing filled with debris, stones or soil) or not
3. Measure the borehole depth (if it is not found blocked) and depth to water table.
4. Take digital pictures of pump head, pipes, platform and surrounding before tripping out pipes and also after tripping out pipes.
5. Collect information on borehole and drilling contractors from local population, District Water Officers, DWD and other databases.
6. Take GPS coordinates

The field exercise will take approximately 3 days and the situation analysis will take 1 week.

2. Borehole rehabilitation

Results from the situation analysis phase will provide knowledge on each borehole that will be compiled to form a detailed work plan. Boreholes with identification numbers will be traced in the TGS and DWD databases to give further knowledge on the borehole (total depth, water strike levels and casing depth). The data collected in the above phase will help know which type of equipment and materials will be needed for each borehole to be rehabilitated. Equipment, materials and personnel will thus be mobilized to the respective sites accordingly.

The following are possible scenarios for each borehole:

1. All boreholes will be flushed (cleaned) using a compressor down to the bottom.
2. Boreholes found blocked/backfilled with debris, soil and stones/rocks; will be flushed with a compressor and / or re-drilled through with a 4" DTH hammer down to the bottom.
3. Boreholes with pump parts (riser pipes, rods and cylinder) detached from the pump head; will require a fishing tool to fish out the pump parts.
4. Platforms and drainage channels found with minor cracks; will be repaired while soak-pits will be re-opened/dug and filled with aggregates.

All boreholes will be flushed with a compressor since they have not been used for some time to remove any dirt.

We Consult also has a borehole camera which will enable a visual assessment of the status of the borehole (silted at the bottom, casing not properly sitting on hardrock, damaged casings screens, why is the borehole blocked). The use of this camera during the assessment will give valuable information that may lead to lower rehabilitation costs.

After fishing out of the pipes and flushing all the boreholes with a compressor down to the bottom, the following will be done

1. Boreholes whose water cleans up during this process, will be test pumped and be installed with riser pipes.
2. Boreholes whose water does not clean after flushing will be installed with 4" pvc casings, the annulus left will be gravel packed. The borehole will be developed, test-pumped and installed with riser pipes.
3. Boreholes whose water cleans after flushing, but are installed with steel casings (normally 6") may be installed with 4" PVC permanent casings on the clients' recommendations. Steel casings are susceptible to corrosion after some time, the fact that water cleans after blowing does not guarantee that water will remain clean for a long time. It is our view that these boreholes have to be installed with 4" PVC casings, annulus gravel packed, developed and test-pumped before pump parts are installed.

Generally, 4" PVC permanent casings will be installed (through the existing 5" or 6" pvc or steel) down to the bottom of the well and a bottom PVC plug used. Screens will be put in the lower section of the well (above 1 plain casing) for boreholes with no information on water strike levels. The annulus (space between the 4" PVC and existing 5" or 6" casings) will be filled with gravel (0.5-1 mm or 2-4 mm diameter respectively) up to the static water level of the well for wells whose information on water strike levels is unknown, and up to the upper most water strike if known. A clay sanitary seal will be put on top of gravel up to 3 m below ground level, above which a cement seal will be cast. This together with a platform will ensure no contamination of the well by percolation of run off and overburden water.

Mobilization will take 1 week and work is expected to take 2.5 days per borehole.

3. Test pumping

Test pumping will be done for all boreholes whose airlift yields after development or flushing are above 300 liters per hour. The purpose of test pumping is

1. Determine the sustainable yield of the borehole
2. Safe hand /submersible pump installation depth
3. Aquifer characteristics of the well (specific capacity and drawdown of well, conductivity, transmissivity and storability)
4. Collect a water sample for water quality analysis

Some terms of reference indicate that the maximum yield of the well needed to be known. As such, all boreholes with airlift yields above 2,000 liters per hour will be subjected to a step test of each 90 minutes in increments of 30% of the airlift yield. Boreholes with airlift yields between 2,000 and 800 liters per hour will be subjected to a short constant rate test of 3 hours at 800 liters per hour while those with airlift yields between 300 and 800 liters will be subjected to a short constant rate test of 500 or 800 liters per hour depending on the well performance. Depending on the clients' requirements, boreholes selected for motorization