International Journal of Agricultural Research and Review: ISSN-2360-7971, Vol. 6(1): pp 670-673, January, 2018.

A Report

Groundwater Drilling Report on komenda Sugar Factory

***Gyamera, E. A**

Department of Soil Science, School of Agriculture, University of Cape Coast, Cape Coast. Ghana.

Accepted 8th January, 2018.

Seftec India Ghana Limited engaged Pekwapong Company Limited Under The Supervision Of Gyam Engineering And Construction Works LTD to provide a drilling services leading to the construction of two boreholes at the site of the Komenda Sugar Factory. Based on the results, air lift yields of 30L/min were recorded for each of the two boreholes. The results also reveal that the underlain rock formation is Sekondian shale with an average weathering depth of 6m.

INTRODUCTION

Seftech India Ghana limited engaged Pekwapong Company Limited to provide drilling services leading to the construction of two boreholes at the ongoing construction site of the defunct sugar factory at Komenda which is within the Komenda-Edina- Eguafo-Abrem Municipal of the Central Region of Ghana.

The scope of works included drilling and construction, well head construction, and pump installation.

Pekwapong Company Limited constructed the two boreholes with an airlift yield of 30L/min recorded for each of the boreholes. The drilling results reveal that the underlain rock formation is sekondian shales hitherto to granite which is quite difficult interms of groundwater exploitation. Information also gathered from the community water and sanitation agency in the central region also indicates that boreholes drilled around the area is normally dry or with marginal yields (10L/min – 15L/min). Pekwapong Company Limited is therefore suggesting that more boreholes should be drilled on the site to get the needed quantum of water for the project since it will be difficult to locate good aquifers with yields more than 100L/min and the hydrofracturing technology can be employed to improve the yields of the borehole for the subsequent boreholes. Hydrofracturing is a technology in which water is pumped under a very high pressure to open hitherto close fractures and hence increase the yield of the borehole. The borehole drilling has been completed and the ensuing pages elaborate on the studies carried out.

GEOPHYSICAL SETTING

A brief description of the physical setting of the project area is presented in terms of geological and hydrogeological conditions, topography, climate, vegetation, and drainage.

Topography and Drainage

The landscape of the Komenda-Edina- Eguafo-Abrem Municipality is generally undulating, dominated by batholiths. Along the coastal zone is a series of lagoons and wetlands which include the Benya, Brenu, Susu, Abrobi and Ankwanda. The slopes and hills are steep in inland areas. In between the hills are valleys with various streams which drain into the coastal lagoons and the Atlantic Ocean. These streams include the Iture and Ante in the west and the Udu and Suruwi in the east.

Vegetation and Climate

The vegetation varies according to the rainfall pattern. There is the coastal shrub and grassland type with scattered trees trading into the coastal savannah forest with a variety of timber species of economic value. The coast itself is mainly 1haracterized by mangrove and palm fronds. The district is generally humid with the 30 kilometre coastline forming part of the littoral anomalous zone of Ghana and experiencing less rainfall than the interior.

Geology/Hydrogeology

The Komenda-Edina- Eguafo-Abrem Municipality is known to be underlain by the Birimian rock type consisting of schist and granites as well as pegmatite and also the Sekondian rocks comprising of shales, sandstone, grits, mudstone and conglomerates. Geologically, the project site is underlain by shale which is shown on figure 1 which represent the geological map of Ghana.

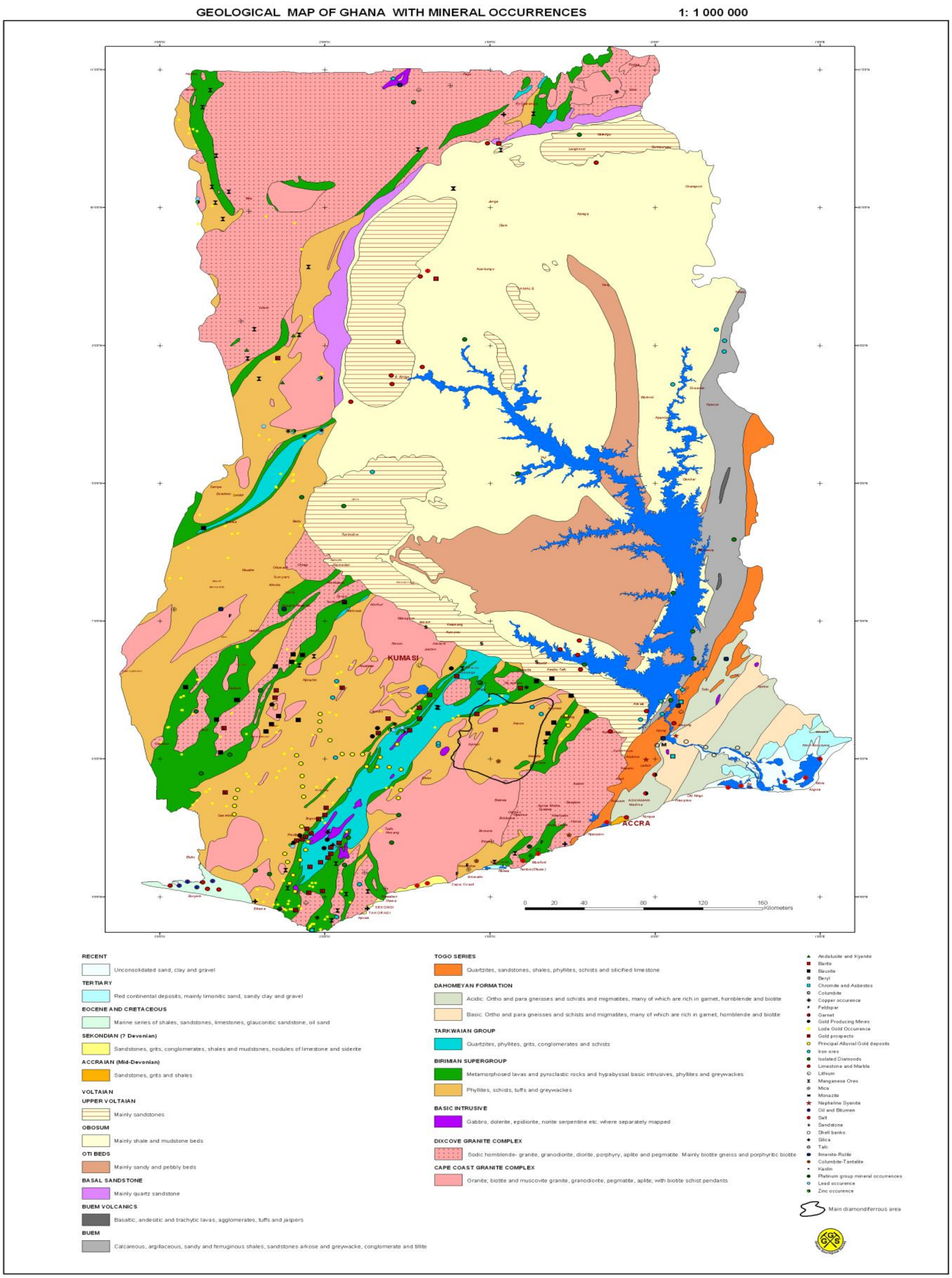

Figure 1: Geological Map of Ghana.

The shale is among the least yielding formations in Ghana in terms of groundwater exploitation. In view of the difficulty of the area as far as locating good aquifers are concerned, it is the suggestion of Pekwapong Company Limited that Hydrofracturing should be included in the subsequent projects to improve the success rate. The water quality in some part of the municipality is normally characterised by presence of concentration of salt and iron.

BOREHOLE CONSTRUCTION

General

Borehole construction took place a few days after the geophysical investigations. Pekwapong Company Limited used a truck-mounted Smith Cap Drilling rig, a compressor also mounted on a truck, and a KIA truck as a supply truck for the execution of the drilling works.

Borehole Construction Procedures

Drilling

To complete a borehole using 125mm casing, a 300mm hole was drilled using an insert bit with air or mud flush, to the partially weathered rock, a 250mm plastic temporary surface casing installed to hold back the overburden. A nominal 200mm (8 inches) hole was then drilled through the underlying rock to the final depth using an air down-the-hole hammer button bit sometimes with water injected into the air circulation in the course of drilling.

When the hole finally intercepts the water bearing aquifer, airlift discharges were measured at regular intervals in the course of drilling. Drilling is stopped when sufficient water, in excess of 13.5 litres per minute, was discharged continuously by the well and the aquifer is adequately penetrated. Formation cuttings resulting from the drilling action were collected at one-meter intervals down the hole as drilling progressed. A driller's daily log gave a complete description of all formations encountered - meters drilled, number of hours spent, etc.

Borehole Design

Plain and slotted PVC pipe casings were used to line the borehole. They had dimensions 125mm and were procured from Interplasts Company registered in Ghana.

All PVC pipes were threaded whereas the slotted ones also known as screens had slot intervals measuring up to 6mm and average opening width of about 1.2mm.

Two basic borehole designs are known; in both cases the PVC lining was installed in the full depth of the borehole. In the commoner design, the screen position starts close to the bottom of the hole spanning the water-bearing zone. The other design type is used in exceptional cases where it became necessary to use screens separated by plain casing. In this case the lower screen was placed at the lower part of the hole to tap water flows from the basement rock, and upper screen was placed against the gritty water-bearing levels found in the weathered zone overlying the basement rock. The length of the screen depended on the thickness of the water-bearing zone (s).

The bottom of the PVC screen was fitted with 1m length of plain PVC to serve as sump for the fines that could not be removed through borehole development. The lower end of the plain PVC was sealed in concrete and the whole unit referred to as bail plug. The diagram showing the complete borehole construction is found in the appendix.

Formation stabilizer, Backfill and Surface Grout.

After the placement of the PVC screens and plain casings, a formation stabilizer was placed in the annular space between the screens and the borehole wall. The formation stabilizer consisting of graded gravel pack (quartz grains) was placed to a minimum of 5m above the top of the upper screen. The one-meter column of the annular space immediately above the gravel stabilizer/filter media was filled with a packaged clay seal or cement grout to prevent clayey and silty water from the over burden draining directly down into the gravel pack.

The remaining annular space above the clay seal was backfilled with formation cuttings to within 4m of the surface or 10m at locations with doubtful sanitary conditions. After borehole development the upper 4m of the annular space was then filled with cement grout to prevent surface water contamination into the borehole.

Borehole Development

After the installation of the PVC lining and the filter media the borehole was developed to remove formation cuttings and other materials from the water-bearing zones, and fine material from the filter media.

Development was done using air-flush method. The process of air flushing was repeated several times until the water in the borehole was judged to be free of sand and micaceous material. Borehole Development was done by the drill rig crew.

Borehole Capping

All borehole lining was completed with the PVC casing sticking to about 0.8m above ground level. The borehole was then temporarily capped with a piece of PVC purposefully designed to protect the borehole until the pumps are installed.

Review of Borehole Construction Results

Borehole Success Criteria

Boreholes are normally considered successful based on the following criteria:

- they have adequate yield (13.5 l/min or more) or where the yield is lower but the boreholes have good recovery rates;
- they pumped clear sand-free water during pumping test;
- the boreholes are sufficiently plumb and aligned, such that the submersible pump for pumping tests and installation could be operated without rubbing or getting stuck on the borehole lining; and
- the water quality has to be acceptable for potable water supply.

CONCLUSIONS AND RECOMMENDATIONS

From the drilling results, each of the boreholes have an airlift yield of 30L/min which is quite successful based on the borehole success criteria by the Community Water and Sanitation Agency and also the fact that the underlain rock formation which is Sekondian shale is among the least yielding formation interms of groundwater exploitations in Ghana.

Pekwapong Company Limited is therefore suggesting that more boreholes should be drilled on the site to get the needed quantum of water for the project since it will be difficult to locate good aquifers with yields more than 100L/min in the Sekondian shales and the hydrofracturing technology can be employed to improve the yields of the borehole for the subsequent boreholes. Hydrofracturing is a technology in which water is pumped under a very high pressure to open hitherto close fractures and hence increase the yield of the borehole.