THE ECONOMICS OF WATER SUPPLY MANAGEMENT IN OBANTOKO AREA, ABEOKUTA, NIGERIA

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ABSTRACT
This paper examined the management of water supply in Obantoko area (a typical Nigerian settlement. Population of the area was determined using building count method and satellite imagery while results of geophysical surveys of the area gave the indication of wield of prospective boreholes in the area. These were used to determine the costs and locations of prospective boreholes that will help maximize the use groundwater supply which is the most prospective water supply source in the study area. A map showing locations of boreholes to be sited and the population they will serve was produced. The study determined that with a population of 57,750 a total volume of 4,025,500 litres of water per day is needed in the study area. This volume of water could be produced from the study area if careful management of the water resources is done, the study concluded.
Keywords: Management, bill of engineering measures, spatial distributions

INTRODUCTION
Water resources management helps protect the world's environment, foster economic growth and sustainable agricultural development, promote democratic participation in governance, and improve health. Effective water resources management requires an approach involving the participation of users, planners, managers, and policy makers at all levels (Ayoade 1975). By first assessing a country's overall water supply and demand, and through improving the ability of governmental and non-governmental organizations to achieve results, and a coordinated response at local, national, and international levels, effective water resources management is achievable (Oteze 1981). Alayande (2005) explained that Water supply in Nigeria is facing serious challenges and supply-oriented indefinite expansion of water supply infrastructures is stressing the available budgetary allocations to the sector to the limit with population coverage below satisfactory level.

This paper examined the problems of water supply and the prospects of water demand management in a community, Obantoko area, Abeokuta, Nigeria (figure 1), thereby assisting government and sector players to reappraise their approaches for a much better result. There has been reported insufficient water supply in the study area, Obantoko area (Ufoegbune et al. 2010), especially during periods of dry season as a result of drop in water level due to insufficient rainfall. When rain ceases completely or frequency reduces in the study area, it reduces the water quantity obtained especially in the houses with poorly constructed hand dug wells. Even during periods of rainfall, infiltration of water into the ground reaches the well thereby causing a mixing of the well water rendering it unusable for most domestic uses. The absence of a proper geophysical survey in Obantoko to determine the best points for the location of a borehole has greatly affected the long term functioning

of the borehole. Usually in Obantoko, residents sink borehole and dig wells with the assumption that every point in the area is suitable for ground water exploration. Eventually these wells or holes are abandoned after a few years since it no longer functions. There is also an uncoordinated development of water supply in Obantoko. As regards this, holes are usually drilled without regards to minding the distance from one to another and leaving out its closeness to different sources.

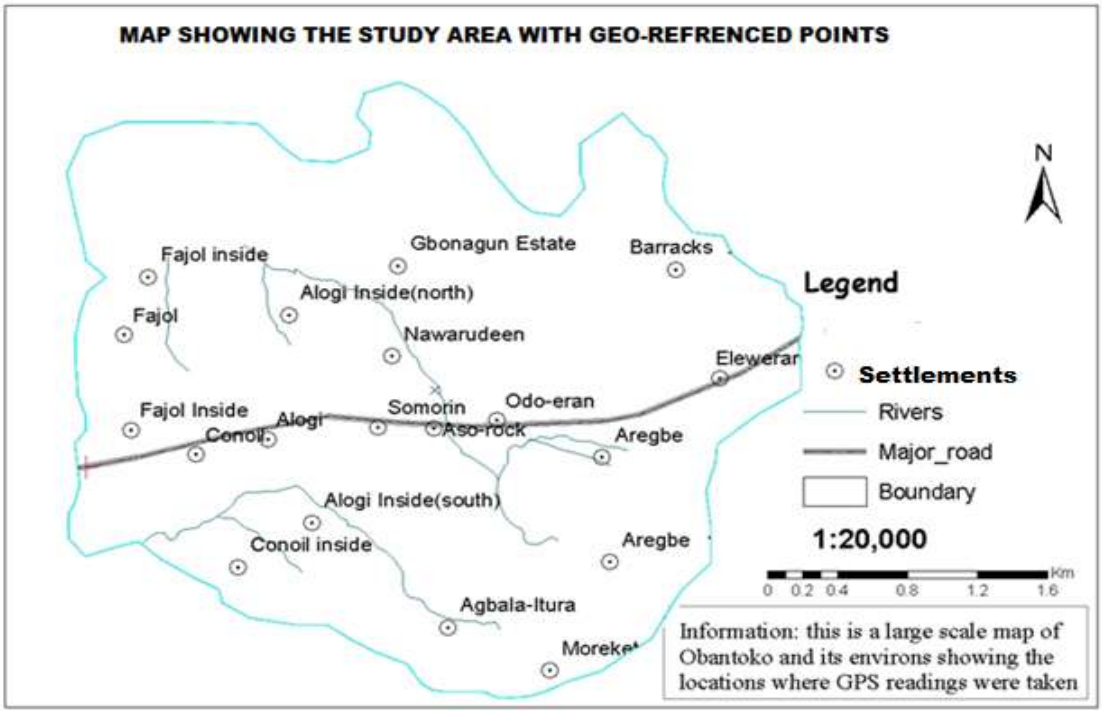

Figure 1: Obantoko showing the quarters

This paper was aimed at providing a model that will help manage the water resources and co-ordinate the development of water resources in the study area, use the geographysical survey report to determine the areas with adequate supply to augment the areas without, to produce a map that shows the spatial distribution of water in relation to the arrangement of the people in Obantoko.

MATERIALS AND METHODS

The satellite images obtained from the google earth map was collected from the 2006 version. This is used to deter mine the population of the the study area which covers from Fajol to Eleweran, using building count method. This study area falls within two different local governments i.e. Odeda local government and the Abeokuta South local government, as such, the population of the study area could not be obtained from the last census statistics. Obantoko was divided into different quarters (figure 1) to estimate concentration of people in each part which will in turn determine how many points will be sited in that location. Geophysical survey report obtained from various sources which include those from the Ogun Oshun River Basin Authority (OORBDA) and from past projects. The method used to carry out all of these geophysical surveys is the Schlumberger vertical soundings. The geophysical

survey report will help determine the cost of drilling at a particular point. This is likely to vary at all points because of the variation in soil profile. The bill of engineering measures and valuation is prepared in the light of the geophysical survey report and the population. This will incorporate the cost of the project and the value (the price of something established by appraisal of its quality, condition, and desirability, or of the cost of replacement) of the project, also the time limit with within which the project could be completed. The number of people in a quarter together with the daily use of each person was compared to the projected capacity of the wells which is dependent on lots of factors e.g the quantity of underground water, pump capacity, occupation of people in that area e.t.c.

Population * consumptive daily use = qty of water required for the area in one day

The volume of water the well can supply in one day was then compared with the quantity water required for the area in one day.

Well yield for one day – qty of water required for that area in one day = well efficiency

Also the closeness of the water source to the residents is also important. A map was produced to show the projected distribution of the water source in relation to the residents and also allowances for residents that can afford pipe connection to their homes. For those that can't connections to their residences, water outlets are to be provided in places close to their homes which will be up for sale at affordable prices. Those that can afford the pipe connection will pay monthly fees that will be affordable and that will balance the quantity and availability of the supply to their homes at all times and in all seasons. Areas with insufficient supply which were detected via the geophysical survey reports will be catered for by the areas with adequate quantity of water this will be done via pipe networking.

RESULT AND DISCUSSIONS

The estimate of population based on dwelling unit count which was obtained from the google earth map using Arc GIS 9.3 (figure 2).

Fig 2: Cross section of the satellite image of the study area showing the tagged rooftops

The total number of rooftops counted is 4,125 and from the reconnaissance survey carried out on the study area, an average of 14 persons per house was estimated. This brought the

total estimated population to 57,750 people in the study area. Based on the WHO standard for the quantity of water required by an individual in one day, the volume of water required in the study area was brought to 4,025,500 litres per day using 70 litres per person per day. The bill of engineering measures that was prepared to determine the cost of this project which was based on an up to date market price of materials and services is given below.

Table 2: Bill of engineering measures and valuation

Item	Description	Qty	Unit	Rate	Amount
	BILL NO 1				
A	PRELIMINARIES				
B	Mobilization of men, equipment and materials to and fro site and construct temporary store at the site.		Sum		150,000.00
D	Preparation of Drilling mud & Excavation of concrete floor.		Sum		100,000.00
				-	
	BILL NO 1 PRELIMINARIES CARRIED TO SUMMARY			**N**	**250,000.00**

Item	Description	Qty	Unit	Rate	Amount
	BILL NO 2				
	DRILLING OF BOREHOLE				
A	Drill semi - manual 120ft through clay and sand		Sum		350,000.00
B	Supply and install of 6" UPVC casing and screen	1	Nr	120,000.00	120,000.00
C	Use of chemical for drilling		Sum		110,000.00
D	Construction of sizeable concrete base		Sum		160,000.00
E	Develop borehole to its optimum yield		Sum		135,000.00
F	Raw water tank	1	Nr	125,000.00	125,000.00
G	Supply and install 1HP submersible pump capable of high yield with pump starter cable safety rope rise pipes,(UPVC - TIGER HEAD) including linking to raw water tank	1	Nr	150,000.00	150,000.00
	BILL NO 2 DRILLING OF BOREHOLE				

	CARRIED TO SUMMARY				**1,150,000.00**

	SUMMARY				
	PRELIMINARIES PAGE 1				**250,000.00**
	DRILLING OF BOREHOLE PAGE 2				**1,150,000.00**
	TOTAL ESTIMATE FOR BOREHOLE TO FORM TENDER				**1,400,000.00**

Excluding the cost indicated in the bill of engineering measures, there are other recurrent costs such as the cost of fuelling the generating set that should provide electricity since the public source of electricity is very unreliable. Also, the management of the proposed borehole location will be handled by individual that will be paid monthly salary. Other recurrent cost such as pump maintaince e.t.c will also be considered. Apart from the provision of adequate water supply, the closeness of the water source to the homes of the residents is of paramount importance. A map showing the spatial analysis of the proposed borehole location and the rooftops which indicate the houses of the people in the study area is produced. This is done by estimating the quantity of water required and from the map allocating more points to the densely populated areas

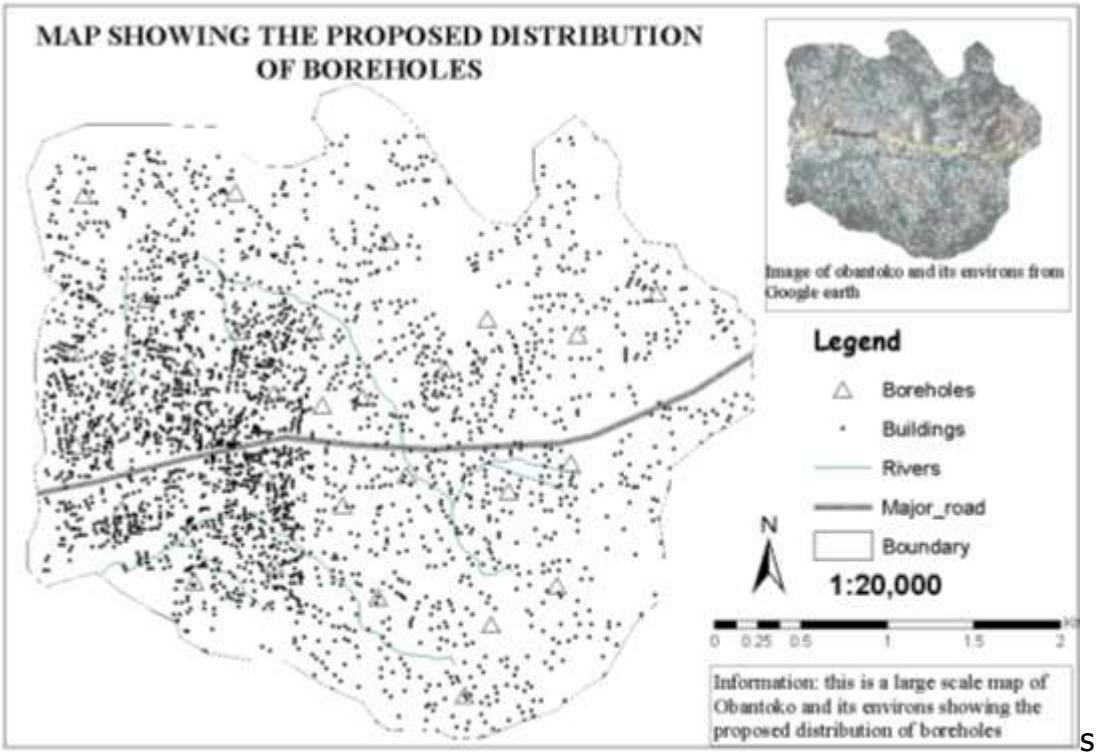

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Fig 3: Map of the study area showing the spatial distribution of rooftops and proposed bore hole locations.

The economics of water supply in Obantoko is aimed at providing effective planning, development and operation of water supply in this area. This is a systematic process that first involves the determination of the population. For the purpose of this study, this was done using the building count method. Satellite images of the study area was obtained from the google earth map, it was then taken to a GIS environment and then digitized to count the number of rooftops in the area. An estimate of the number of persons per house based on a reconnaissance survey is used to multiply the number of rooftops which summed up to the estimated population. The volume of water required in the study area is estimated according to the WHO standard of water quantity. The ground water potential was analysed using the geophysical survey report collected. This helped to examine the quantity of water that could be generated from the boreholes drilled in the study area. A map is produced to this effect showing the spatial distribution of proposed borehole location and buildings.

After this a bill of engineering measures is prepared as regards this project to be able to put a figure to the total monetary value of the providing sufficient portable to the study area. Using the population estimate which is 57,750 a total volume of 4,025,500 litres of water per day is needed in the study area. From reconnaissance survey, a borehole in Obantoko will be able to yield close to 15,000 litres of water in one day. Mathematically, over 250 boreholes will be needed to supply the study area with adequate water. Basically, when there are too many holes drilled into the ground a possibility of an earthquake occurring could be considered. But in rainforest areas like Nigeria, especially Abeokuta where the ground water

recharge is reliable because of the presence of rainfall percolation, the possibility of the earthquake occurring is greatly reduced since most of the holes are not likely to be empty at any point which is the likely cause of the earthquake.

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