ALLEVIATING WATER SHORTAGES IN UNIVERSITY OF ILORIN TEACHING HOSPITAL, KWARA STATE, NIGERIA.

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ABSTRACT

Adequate water supply is a necessity to life and an essential infrastructure in a major tertiary Hospital. This study looks into the current situation and future solution to the shortage of water experienced in the University of Ilorin, Kwara State, Nigeria. Total water demand was 332m3/d. considering immediate future expansion; water demand was put at 400 m3/d. Source of water was borehole yielding about 115 m3/d when working at maximum capacity, total of 20m3 water was supplied by 2 water tankers per day revealing a shortfall of 197 m3/d. Possible solutions were examined using Linsley adapted method: Surface water or river intake, direct supply from existing sources and construction of dams. Their various merits and de-merits were examined and the most appropriate to meet current and future demand was selected for intervention. Construction of additional boreholes, adequate maintenance and monitoring were recommended.

Keywords: *Water shortage, Hospital, Ilorin, Water demand, Borehole*

INTRODUCTION

Adequate and sustainable water supply system is a necessity for a tertiary hospital. Water always seeks to find its lowest level, in so doing, may remain on the surface in form of streams, rivers or lakes, it may also find its way underground by soaking through the soil and settling at whatever level the subterranean strata dictates. Therefore Sources are either through ground water or surface water. The elements that make up a modern water supply system include the source of supply, storage facilities, transmission to treatment facilities, treatment facilities, transmission from treatment and intermediate storage facilities to distribution facilities (Linsley *et.al*., 1992). Safe transmission serves the ultimate purpose of conveying the water to the consumer. In spite of the importance of adequate water supply to humans, access to potable water supply in Nigerian cities lag behind demand.

Although Nigeria is blessed with abundant water resources, considering total run-off of 600million m3 / d or 5700L / C / d from Nigeria's Basins (Martins, 2001). Governments at all levels (federal, state and local) have not been able to successfully harness these resources to ensure a sustainable and equitable access to safe, adequate, improved and affordable water supply and sanitation to the population (Ohwo and Abotutu, 2014).This situation has been confirmed by studies of different cities in Nigeria and Ilorin capital of Kwara state in particular with a population of 606,533 in 1996 with a growth rate of 2.83% and in 777,667 in 2007 comprising three local governments (Ilorin East, Ilorin South and Ilorin West). This figure shows that the growth rate is about 2.82%, which follows the growth rate as proposed by NPC (2006) (Ayanshola, et al., 2013). The provision of water supply and services in Nigeria has been traditionally regarded as a social responsibility of the Government; Findings from a city in Kwara as reported by Sule and Okeola 2010, only 8% households got water supply at least five days a week, 34% only get water once a week and 21% do not get water at all. Looking at the water problem in the area, it was obvious that an overwhelming majority depend on a secondary source of water supply.

About 54% of the households depend on well water while 35% rely on borehole and 7% on a water vendor. Also 98% of the households have storage facility within the household as services are not regular. In this regard 50% make use of plastic / metallic drums while 20% utilize jerry cans for this purpose. Reports from other cities in Nigeria equally echoed similar situations as obtained in Lagos and Warri-Effurun metropolis, Ibadan, Nnewi, and Yenagoa (Ohwo and Abotutu, 2014). Area of study is a well patronized tertiary Hospital located in Ilorin, Kwara State where amenity like water supply is expected to be high however as experienced in other parts of the City and reported by WHO, 2015 that in low- and middle-income countries, 38% of health care facilities lack any water source, water shortage was a serious challenge in the Hospital. This study looked into possible means of overcoming the problem in terms of present and future water demand with the aim of proffering solution to current and ultimate water demand of the Hospital.

MATERIALS AND METHODS

This study used quantitative analysis to estimate current and future water demand of a Healthcare facility located within basement complex geographical location in Ilorin Kwara state capital. Ilorin lies between latitudes $8^{o}25$N and $8^{o}32'$N longitudes $4^{o}30'$E and $4^{o}41'$E (Mokuolu *et al*., 2014; Ayanshola, *et al*., 2013). It is a major Hospital with 600 bed capacity and providing emergency, medical, surgical, radiology, obstetrics / gynecology and child health services. It is a medical health institution which also trains medical students while offering health care services. The Hospital has over three thousand employees which include various professionals like Doctors, Nurses, Laboratory Scientists, Pharmacists, Engineers, Physiotherapists and Imaging Scientists. Others are: social workers, Nutritionists, Caterers, Accountants, Administrators, etc. The hospital renders health care services to an average of one thousand patients per day.

The study approach was grouped into three main parts:

a) The determination of current and future demand; The baseline study was by direct observation / key informant interview and quantitative analysis
b) The appraisal of all possible means to meet these needs.
c) The selection of the most feasible and sustainable approaches for satisfying the anticipated requirements while considering the methods of Engineering economy to accurately determine the optimum solution.

RESULTS AND DISCUSSION

Existing Water Supply Situation *(baseline study)*

The main Source of water was the borehole.

- 10 (ten) boreholes were on ground, 8 (Eight) of them were reticulated
- Water yield / output of boreholes unknown
- Physical, Chemical and Biological characteristics of water (water quality) was yet to be established

Existing water distribution

The Hospital had 2 over head tanks (45,000L each), 1underground (300,000L capacity), 1 surface (45,000L capacity). Water was being pumped directly to overhead tanks from 4 boreholes, surface tank received supply from 2 boreholes while the underground received supply from 1 borehole. The

remaining 1 number borehole was connected direct to the pipe network. Pipe sizes range from 25mm to 100mm diameter. There was no record of water distribution system design.

Water Shortage

Qualitative data through In Depth Interview (IDI) showed there were occasions when the boreholes develop technical problems (pumps or pumping panel) or Electricity Supply failures. Through IDI and direct observations, there were complains of water shortage by the hospital community.

Water Demand

The demand for water varies from ward to ward, to residential quarters to Administrative departments. Hospital water demand according to WHO

Table 1. Water use and quantities

Use	Quantity (L/day)
Hospital with laundry facility	220
Outpatient	5
Office staff	30
Staff accommodation	220

Table 2. Water use according to facility

Facility	Population	Water use (L/day)
Wards and clinics	505	111,100
Residential quarters	272	59,840
Hospital staff	3188	95,640
Other staff	500	15,000
Out patients	1190	5950
Others (wetting flowers, washing drains etc)		15,000
Total demand		**292,530**
Add 10% waste/ losses		**332,000 (approx.)**

Based on assumption, considering immediate future expansion, water demand is put at 400.000L / d or 400m3 / d

Solutions to water shortage

Sources of Supply:

Possible sources of water supply can be found in any of the following (adapted from Linsley et al., 1992):

a. Construction of boreholes
b. Surface water or river intake
c. Direct supply from existing sources
d. Construction of dams.

Construction of Boreholes

Main source of water supply currently was the borehole. According to Jimoh, 2010, Geohydrological and resistivity studies in basement complex which Ilorin lies is low (ranging from 7200L / d to 14,400L / d).

Following this investigation study, 8 boreholes current in use can yield max of (8 x 14,400)L / d amounting to 115,200L / d (115.2m3 / d) when in full operation, additional 20,000L / d was supplied by two water tankers owned by the Hospital which brings water from other sources, meaning a shortfall of about 196,800L / d (196.8m3 / d).

Surface Water or River Intake

The only source, considering this option is river Oyun which runs through the Hospital. It has an annual flow of over 80 million m^3 (source: KWWC) whereas annual water demand of the Hospital was 146,000m3. It was observed that the river runs dry during the dry season therefore this option need not be given any serious consideration.

Supplies from Existing Sources

Raw water is available for Ilorin community at Agba, Asa and Sobi dam. Total possible yield from the three dams is 135,000m3 / day.

Breakdown is as follows:

Asa dam yield: 112,500m3 / d
Agba dam yield:13,500m3 / d
Sobi dam yield: 9000m3 / d
Total yield= 135,000m3 / d
(Source: Kwara State water corporation (KWWC))

Requirement for Ilorin Community is about 180,000m3 / d. Two options can be considered using this source for water supply.

Option 1

The Kwara State government had planned a 25,000 m3 water reservoir at Oke Ose to supply the Hospital and its environs.

Advantage

When completed and commissioned, this option will meet the hospital demand.

Disadvantages

1) When there is a breakdown at Asa water works, no water can be obtained from the urban system.
2) Complete dependent on state government supply

Option 2

Direct supply of raw water from existing supply: The raw water is to be directed to a treatment plant which can be located at the water works area of the hospital. The water is then treated and pumped into existing water line.

Advantage

How much water to be treated and when can easily be decided.

Disadvantages

1) When there is a breakdown at Asa dam waterworks, no water can be obtained for treatment and supply to the Hospital.
2) Expensive in terms of capital cost.

Construction of Dams

The main river Oyun is dammed by the University of Ilorin for her community use. One of the tributaries of this river runs through the Hospital. The

yield of this tributary is not yet determined at the time of writing since investigations on run-off has not been carried out.

Water is an essential infrastructure in healthcare facility and necessity for human existence. Nigeria is blessed with abundant water resources, but largely untapped Government at all levels (federal, state and local) have not been able to successfully harness these resources to ensure a sustainable and equitable access to safe, adequate, improved and affordable water supply (Helladendu,2012). The ultimate source of all natural potable water on the earth is rain, Nigeria's groundwater potential is estimated at 106 x109m3 (Martins 2001; Adah and Abok 2013). Use of borehole water is a well known and accepted as a source of water supply in Nigeria (Sule and Okeola 2010; Ohwo and Abotutu, 2014). The quality of water produced by the hospital borehole was not ascertained however report by Yusuf et al., 2012 indicated that quality analysis of boreholes sample in Kwara state were suitable for human consumption.

CONCLUSION

This study has established that the source of water to this tertiary health facility was inadequate to meet the demand. There is an urgent need for the Management to take a decision to supplement the shortfall.

Adequate treated water could be obtained from Kwara State Government supply to meet the Hospital's current and immediate future expansion needs but this cannot be totally dependable as this will involve going beyond the hospital boundary to meet her necessary need. Construction of additional ten boreholes to augment the existing ten boreholes in addition to on-going efforts on urban supply will alleviate the current shortage.

In addition the following recommendations are made:

1) That wastages be reduced to near zero by changing faulty taps, damaged pipelines, faulty water closets.etc
2) Construction of ten boreholes to augment the current ten numbers.
3) A good relationship with the Kwara State Government / KWWC.
4) Further studies on Oyun River for possibility of a dam.

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