

## E A ANYAHURU

### PIPE-BORNE WATER SUPPLY IN A TRADITIONAL SOCIETY - NIGERIAN CONDITION

#### INTRODUCTION

Pipe borne water supply in rural areas has received more publicity than the attention it deserves in most parts of Nigeria. In the urban centres, the story is not very different. A false impression is created that everybody in the society including those in government appreciates the role of clean water in a healthy society. Funds for executing water projects are lacking when the figures are put forward. Projects started for Enugu, Nsukka, Abakaliki and Aba in Anambra and Imo States have virtually grinded to a halt due to lack of funds.

Several problems militate against the formulation of working and workable government policies on the distribution (allocation) of this essential commodity, water, under a stringent financial constraint. The practice of communities raising funds to build their own water system may not be economical in the long run. It is believed that the most economical use of water resources is that which is based on a regional distribution: small community projects may not fit into the regional network.

1. Administration: There are three levels of government in Nigeria - Federal, States and the Local Governments. It is the responsibility of the state governments to provide potable water to both urban and rural communities in the country. In the most recent development in government, states have created Ministries of Utilities which, in some states have limited scopes - Water Supply and Rural Electrification. In addition to this new ministry, there are state owned Corporation/Boards charged with the Authority to ensure that government policies on Water Supply are implemented, or in some cases, evolve policies on Water Supply in the states. There are provisions for Advisory Water Committees in the local areas to act as links "between the Water Corporation and the locality served by the committee" (Edict, 1976).

2. Government Policy on Water Supply: It has not been easy for many state governments to define working and workable guides for siting a pipe-borne water project in the

state. Should a water project be sited according to need knowing that potable water is an absolute and natural necessity? Should the most depressed and neglected section of a state be compensated with a water project? Should a community be required to deposit a fixed sum of money per capita to enable the government mount a water project for the community? If so, what percentage of the project must the community contribute before government approves the project: How effective should personality cults be in the location of water projects?

The above questions highlight some of the problems of the distribution of this limited resource. If funds were limitless, there would be pipe borne water in every village, hamlet and household.

3. Components of a Water Project: There are communities whose underground formations contain "underground rivers". If a hole is dug on such places to the depth of these formations, water collects within the hole. A suitable device installed into the hole facilitates the abstraction of the water for domestic and other uses. In Imo State, Local Government Areas like Ukwu, Obioma Ngwa, Isiala Ngwa, Owerri, Aboh, Egbema/Ohaji/Oguta, and most parts of Abiazu and Oru are enriched with abundant ground water. The chemical and bacteriological qualities of the water are very satisfactory, requiring no serious treatment. It is quite soft with low pH averaging 5.0 in samples from over ten isolated boreholes. The following components are required to draw such an underground water up to the surface and down into a standing public tap or domestic plumbing fixtures:

- 3.1 (a) Development of source through wells or boreholes. In our present practices two boreholes is a minimum in a station. This unit may take up to 20% of the total cost of a project;
- (b) An electric generating set and a building to house the set where central electric power is absent. This unit takes up to 6% of the project cost;

- (c) A storage, normally able to take about half-a-day's consumption, or a whole day's consumption. This can be a ground level tank or an elevated tower, depending on the general topography of the area. It could be constructed in pressed steel or in reinforced concrete. The unit consumes up to 32% of the project in relatively flat terrains;
- (d) Pumps and accessories at estimated cost of 6% of the total cost of project;
- (e) A network of pressure pipe lines to connect the source (a), the storage (c), and the location of the standing public taps. Depending on the scope of area to be served, this unit may consume over 36% of the total project cost.
- (d) A storage as at item 3.1 (c), may consume about 30% of the project;
- (e) A network of pressure pipes as at item 3.1 (e) may take up to 30% of the project cost.

On the other hand there are communities which have to be supplied with adequate potable pipe borne water from surface water sources such as rivers, streams, lakes, brooks and springs. Ohaozara, Afikpo, Okigwe/Isuikwuator, Arochukwu/Ohafia and parts of Umuahia/Ikwuano, in Imo State are some Local Government Areas that have this singular handicap with their water supply. This is a handicap because there may be a collection of communities that do not have perennial streams for a stretch of over 10km. Pipe-borne water can only get to such areas through extensive pipe network. Although industrial pollution is not a major problem yet in the rural areas, the water from most of the streams have to be treated to remove colour, turbidity and silt in the rainy season. This means extra running cost for a water scheme. The following components may be required to draw the water out of the stream and make it potable at the standing public tap:

- 3.2 (a) Development of source through embankments, impoundment, dams, weirs etc. Depending on the location of the source and its pollutional load, the water may undergo a full or partial chemical/bacteriological treatment to make it potable. The cost of this unit may run as high as 30% of the total cost of the project;
- (b) A generating set or generating sets and accessories. Though the cost of this unit may be similar to those in item e.1 (b), it may constitute less than 5% of the project;
- (c) Pumps (high and low lifts) with accessories may consume less than 5% of the project cost also;

4. Cost of a Water Project: Pipe borne water project may take one of the forms described in item 3 above. Table 1 shows a cost breakdown of a water project for a community of 10,000 people (including women and children). Cost details will vary with local conditions, but figures in Table 1 are taken from present-day market prices for on-going water projects in Imo State (Table 1). The figures in this unit give a unit cost of ₦39.30k per consumer. For a project which is financed entirely by the community, a farmer with eight children should contribute ₦ 393.00 towards the water project. Only very few rural communities in a Nigerian society can fund this project and execute it in a logical sequence without suggesting the purchase of a generating set first because it is the cheapest item of the lot. Communities volunteer to undertake the trenching for the pipeline, but this item comes up in the last phase of the project.

Pipe extensions in 100mm and 75mm to remote villages or villages outside the path of the main pipe line are additional costs which will have to be borne entirely by the local councils or the villages.

5. Economy and Sophistication: In the thirties and early forties, the colonial government in parts of southern Nigeria dug a number of 1 200mm (4'.0") shaft open wells to provide "clean" water to villages where it was technically feasible to do so. Women and children drew water with ropes and buckets in a very unhygienic manner. Buckets from various homes and contaminated well surroundings converged in the wells. The level of economy reflected in this crude method of water supply was distinctly different from the pipe-borne water supply system enjoyed by the Europeans and other township dwellers. In the townships, potable water was piped into homes at the European Quarters. A few standing public taps were located at some road junctions for other township dwellers. With independence in 1960, experimental boreholes were drilled in parts of the former Eastern Region with electric or diesel powered pumps to pump the borehole water into reservoirs and towers in small pilot rural pipe-borne water schemes built by the governments. From the generally simple standardized cylindrical reinforced concrete water tanks a network of pipes radiated to parts of some communities. Communities near the scheme collected money for pipe extensions to convey the water to their village centres. The per capita daily

Table 1: Cost Breakdown of a Rural Water Project  
From Borehole Source

S/No.	Description	No./Unit	Rate	Cost
1	200mm boreholes	2 Nos.	40 000.00	80 000.00
2	Generator House	1 No.	15 000.00	15 000.00
3	Generating Set	1 No.	10 000.00	10 000.00
4	Pumps Complete	2 Nos.	12 000.00	24 000.00
5	450 cubic metre steel tower	1 No.	120 000.00	120 000.00
6	150mm pipes	8,000m	18.00	144 000.00
Total		-	-	393 000.00

water consumption was of the order of 23 litres (5 gallons). This was the beginning of the sophistication in community water supply which, less than twenty years later has become the standard method of pipe-borne water in our rural centres. Today, boreholes have tragically become synonymous with rural water supply especially to the uninformed public. Only very few of the water schemes were constructed because government could not fund many of them at the time.

Following the bitter experiences of 1966 and the subsequent civil war, there is now a general tendency for people in the Eastern States of Nigeria to develop estates and modern residential homes in their villages. Such estates are hardly complete without modern water closet toilet systems which depend on a reliable public water supply. There is therefore a demand to provide pipe-borne water in the villages, not simply to satisfy the requirements of the traditional village dwellers, but to meet the demands of the few elites who are used to such sophistications in the urban centres. Though the level of economy can ill afford the luxury of the duplication of modern pipe-borne water system - in the villages and urban centres - and though the elites are few in number, enjoying village facilities at the weekends and during annual vacations, Water Authorities are made to provide them even at the risk of inefficient and irregular operations in the main urban centres. There are no studies to justify the slogan that rural water supplies will directly stop or even minimise the general drift into the urban centres where many other opportunities exist for young people.

6. Contributions for Water Projects: Some communities initiate development projects to attract government grants. Most of the projects which have been successfully executed by communities through the combined effort of the people and the various levels of government include construction of school blocks, short span bridges, earth-roads and market stalls. Cash contributions of up to ₦ 20,000.00 invariably go a long way

towards the completion of the unit, or it might make a significant impact on the structure to the extent of attracting the attention of outsiders including the various levels of governments. In Water Supply project, the matter is not so simple as illustrated in Table 1 for a simple rural water project.

7. Practical Designs: The design of any public utility services in a developing economy is beset with a multiplicity of problems. Nothing is certain or definite in the design parameters which are required for effective sizing of the components of the services. Initial population figures, population dynamics, per capita demand, and the probable life of the utility are unknown parameters in this country. There are no maps. Wherever it is possible, design figures and safety factors are lifted from British, American or German literatures depending on the designer's educational background. There are no Nigerian national codes for Water Works practices. These imported standards may not tie with local conditions, and the resulting designs may not be economic. Some engineers even tend to consider the application of a rigid engineering principle in water supply practices as a mere academic exercise. This is very unfortunate.

Amidst these problems of under-development is the politics associated with the distribution of a scarce commodity. Water supply is a political issue. The location of a water project may be based on a political consideration with little or no bearing to the direct cost of the project or even the technical feasibility of the venture. It is not uncommon to drill a borehole drilling team into a village or group of villages sitting on top of shales to give water to the people. The result is money wasted on abortive or dry boreholes. There are instances where communities have volunteered to have their own separate water project in preference to water from a nearby unfriendly community. These underlying and in-built social and political difficulties militate against the application of engineering principles to design economic projects. However, the following detail design

Procedures have been found to yield a measure of economy in some of the state-owned Water Corporations and Boards:-

- (i) A Request for a Project - A request or proposal for a community water project is initiated by community leaders. There should be an arm of government responsible for the welfare and general development of the rural communities in a state where water supply services have been programmed and phased out for execution. The proposal for a project is accompanied with a list of all the villages and establishments to benefit from the proposed water project;
- (ii) Preliminary Investigations: Maps showing the locations of the villages, where available, and in the appropriate scales with contour lines, are assembled. It will be easy to determine whether the villages can be supplied through pipe extension from existing water schemes or to locate a possible source and nature of treatment if any. Available maps may have to be blown up (manually) in the Drawing Office. Some natural features may be lost in such a map necessitating site visits by the engineer to locate some of the essential features. Where no maps exist, the surveyor goes to prepare plans of the main roads and paths with spot levels. Villages and village centres are located on the plan.
- (iii) Preliminary Design: In this country, the only official population figures are those of 1953 and 1963. These figures can be collected from the Community Development Divisions of Local Government Councils. This two point graph is a basis for population estimation, generally based on a geometric rate of growth. Per capita daily water consumption of 50 litres is considered a reasonable rate for the initial development of the source (for ground water sources). A maximum rate of 90 litres per capita per day in 20 years when habits on water usage in the village should have become stabilized assists in sizing the trunk mains. Storage should cater for a day's demand. Where a standby pump or borehole is provided for only ten hours demand - a 450 cubic meter pressed steel tower on 10m piers could be made a standard storage for communities of up to 10 000 people in relatively flat areas.

Quite often there is a need to provide standard boreholes in a state to minimize maintenance problems in a country where all components of a pump are imported. This may lead to unnecessary wastage in resource allocation where a small isolated community of less than 5 000 people may be supplied with water from 300mm boreholes each yielding

over 50 litres per second (40 000 gallons per hour). It may be uneconomical to extend water from such an isolated community to the others. A balance has to be struck between designing a large central project for groups of villages or communities, even inter-local government areas and isolated small schemes for individual locations. The former is preferred for ease of maintenance. Based on the demographic distribution of villages in the coastal plains of Imo State, it is observed that when trunk mains get beyond 250mm, it may be more economical to consider the location of another water project in the area. Designs of this size cover 6 to 10km radius in these rural areas.

At this stage the Water Authority's detailed report will contain a reliable cost estimate to enable the financier decide on the stages for executing the particular project. The financier, usually the government, can decide to complete the project in phases, stretched over a number of years.

7. Execution: The project can be executed according to the following four year schedule:

- (i) First year - Prepare the design including the costing of the project;
- (ii) 2nd year - Drill the boreholes or develop the intake and indent for the pumps and other electromechanical equipment. Build the storage tank;
- (iii) 3rd year - Complete the storage tank. Install the pumps, generators etc. and connect up the pumps and tanks. Provide public standing tap so that communities along the trunk mains already laid, and those situated in the vicinity of the storage tank can begin to draw potable water from the public taps;
- (iv) 4th year - Laying of all the remaining large diameter pipes, namely 250mm, 200mm and 150mm to the centre of the design areas.

After laying the 150mm pipes, the government can hand over the completed water project for operation and maintenance. Further pipe extensions in 100mm and 75mm pipes which can still take the water up to 2-4km from the trunk mains depending on the topography and demand, can be continued by the communities through community efforts and contributions.

#### CONCLUSION

State governments have set up the machinery for the control of water supply services. There are, however, numerous socio-political forces which militate against equitable distribution of these services. Pipe-borne water schemes are very expensive projects to be left to communities to finance without government support. By applying basic principles in engineering design however, a

community water project can be phased out through a period of four years (ideal for the present political set-up in the country). In this way, a pipe-borne water project initiated by a regime on assumption of office will be duly completed before the next election. Those not completed are to be taken over from well defined stages which make for easy completion.

The essential components of a pipe-borne water scheme, namely - (a) Source development, (b) power supply, (c) water treatment where it is necessary, (d) storage, (e) provision and laying of pipe trunk mains, 150mm and upwards should be a government responsibility. Pipe extensions in 100mm and smaller diameters can be undertaken by communities with government technical advice.

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