

M S ABID**KADUNA WATER SUPPLY EXTENSIONS -
BARNAWA DAM PROJECT****INTRODUCTION**

Kaduna, the capital of Kaduna State of Nigeria is situated between $10^{\circ} 26' N$ and $10^{\circ} 37' N$ latitudes and $7^{\circ} 24' E$ and $7^{\circ} 29' E$ longitudes. The Kaduna river flows through

the city, dividing it into Kaduna North and Kaduna South. The total area of Kaduna is 115 sq km, with an estimated population of about 550000. Kaduna has enjoyed treated water supply since 1929. Although measures for increasing Kaduna water supply have been

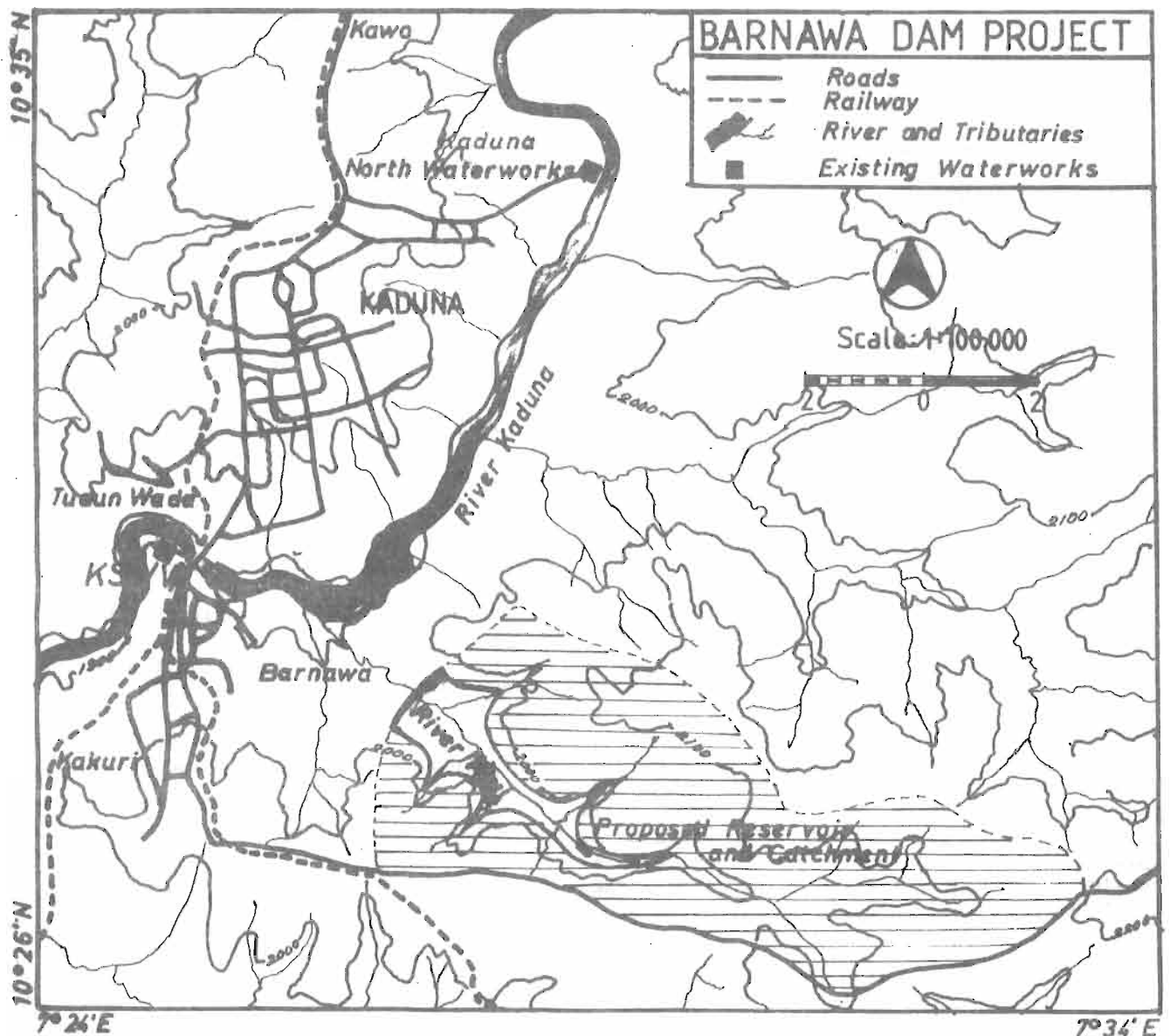


Fig:1 Map showing Kaduna city, the existing Waterworks and the proposed Dam.

taken from time to time, they proved inadequate for the soaring population and growing industry. Kaduna State Water Board engaged the services of Ward Ashcroft and Parkman (Nigeria) as consultants, who recommended extension at Kaduna North Water Works only, and phasing out of Kaduna South Water Works (Reference 1). This proposal is for a dam on Kuyi river, a tributary of Kaduna river, which will ensure about 136mld when fully developed, enough for the needs of Kaduna South until the end of the century. As the tributary is downstream of the North Water Works, the project will not affect any development there. The project is not only economical, but can also be further developed into a recreation centre, (Figure 1).

CONSULTANTS' REPORT

The Consultants made two alternative studies of the project, ie a) Extensions at the North Water Works only and ultimate phasing out of the South Water Works, and b) Extensions at both North and South Water Works to serve Kaduna North and Kaduna South seperately. Tables 1 and 2 show the development proposed by these studies.

The Consultants recommended the first proposal that all new treatment plants be sited close to the existing North Water Works and phasing out of South Water Works, although

it would involve higher costs. The Consultants recommendations are based on pollution of Kaduna river at Kaduna South due to discharge of effluent from populous Tudun Wada, Tudun Nupawa and Sabon Gari, upstream of the South Water Works, which contaminates the raw water to a great degree. This view is supported by another Consultant, Louis Berger Incorporated Nigeria, engaged by the Water Board for a pollution study of Kaduna river.

THE PROPOSAL OF BARNAWA DAM

The proposal is to make an earth dam on Kuyi river, a tributary of Kaduna river with a catchment of over 39 sq km. Although the tributary is seasonal, yet some springs upstream in the catchment keep it flowing throughout the year with a minimum average discharge of 2 cusecs during the dry season.

To check feasibility, however, flow discharge studies and subsurface investigation along the axis and abutments will be necessary. If this proposal is implemented, there may be no need to shift the entire Works to Kaduna North as suggested by the Consultants. River pollution problems faced at Kaduna South will also be overcome since the Barnawa reservoir will not have any major source of pollution.

This project will not only be much more

Table 1. Scheme A
Schedule of Water Works

Water Works	Proposed Phased Development in mld			
	# 1980	Stage I 1983	Stage II 1989	Stage III 1995
Existing North Water Works	89	89	89	89
New North Water Works	-	115	160	205
Existing South Water Works	27	##	-	-
Total	116	204	249	294

Table 2. Scheme B
Schedule of Water Works

Water Works	Proposed Phased Development in mld			
	# 1980	Stage I 1983	Stage II 1989	Stage III 1995
Existing North Water Works	89	89	89	89
New North Water Works	-	-	40	40
Existing South Water Works	27	27	27	##
New South Water Works	-	110	110	165
Total	116	226	286	294

Capacity after Emergency Extensions which will add 445 mld.
Existing South Works taken out of commission.

economical as far as capital expenditure is concerned, thus reducing the foreign exchange component, but it will also have much less operational expenditure compared with any other proposal on Kaduna Water Supply Extensions.

HYDROLOGY

Discharge studies of Kuyi river are only available for one year, but calculations based on average annual rainfall, (Figure 2), and catchment area suggest that an 18m high and 1 kilometer long earth dam will be able to

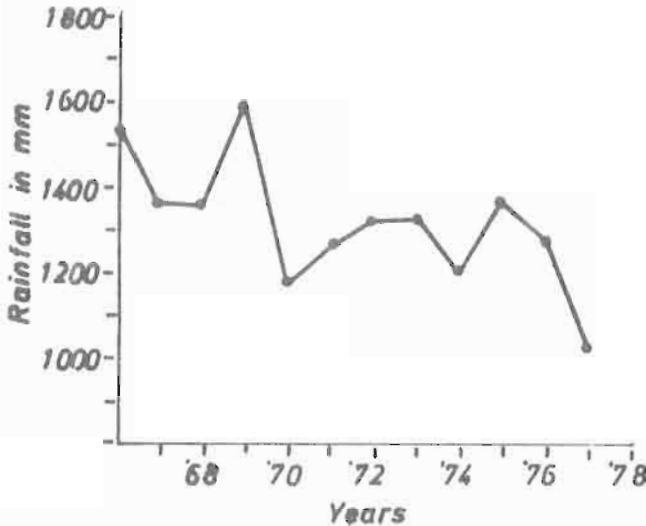


Fig 2 Average annual Rainfall in Kaduna south Ref. 3

store over 27 million cubic meters, (Figure 3). This storage will be sufficient to provide approximately 136 mld of raw water for the consumption of Kaduna South after accounting for evaporation and seepage losses, (figure 4)

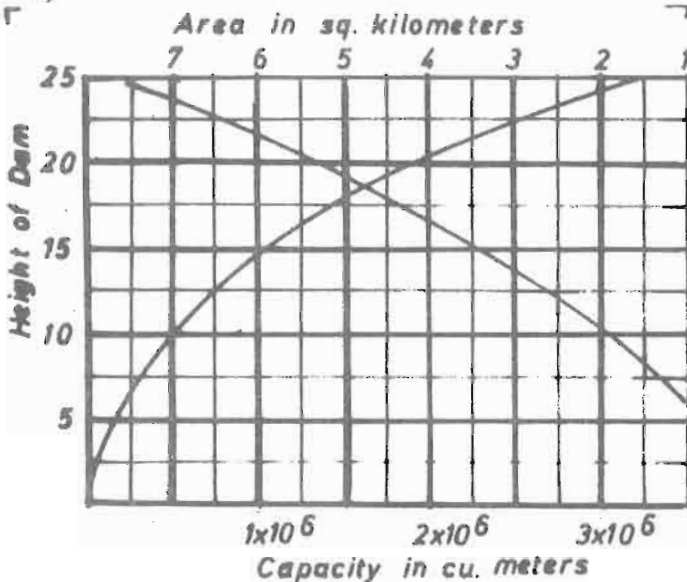


Fig:3 Area Capacity Curve

The reservoir capacity will be 405 hectares.

CIVIL WORKS

As per preliminary studies, the earth dam at Kuyi river will have a reinforced concrete

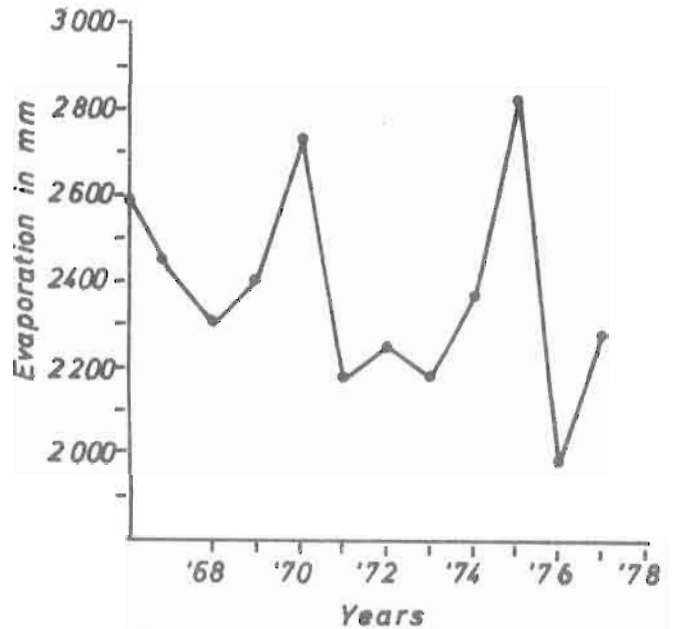


Fig:4 Pan Evaporation at Kaduna south, Ref. 3

spillway and an emergency spillway. The construction of these hydraulic structures will take about 9 months.

Besides for water treatment, a complete water works comprising an intake, sedimentation tanks, clarifier, rapid gravity filters and treatment works are also proposed to be built at Barnawa near the dam and the reservoir. The whole project can be completed within two years. Any suitable equipment can be transferred to the proposed new works at Barnawa to keep it centralised and save expenditure on operation and maintenance. Another advantage of building water works and service reservoir at Tudun Wada village is its high contour which will ensure gravity distribution thus further reducing maintenance costs.

An alternative will be to make an intake at Barnawa and pump raw water to the existing South Works for treatment and distribution. The capacity of the South Works can be increased by increasing the capacity of the treatment works.

The whole scheme is expected to cost not more than 5 million naira at current prices.

RECREATION

Apart from water storage for supply to Kaduna South, the Barnawa Dam reservoir will attract hotels and other related industries. Artificial beaches, gardens, childrens park, sports centres, gymnasia and recreation centres can be developed near the reservoir which will not only add greatly to the beauty of Kaduna city, but will also be financially beneficial to Kaduna State Water Board in particular and Kaduna State in general.

CLIMATE

The location of a large lake close to Kaduna

will result in more vegetation, which will have good effects on weather and general climate. The dry weather will be reduced, nurturing better health conditions for the residents of Kaduna and its suburbs.

RECOMMENDATIONS

A guage was installed on the stream in 1979. It will be worthwhile to install a 'V' notch weir also to accurately determine the stream discharge.

Subsurface investigations by core drilling along the dam axis will be important to determine the foundation conditions.

CHEMICAL STUDIES

Raw water samples from different points in the stream should be collected for chemical, bacteriological and pathological examination, to assess the quality of raw water and the treatment needed.

CONCLUSION

This proposal is expected to save at least 10 million naira on the overall cost of the Kaduna Water Supply Extensions proposed by the consultants.

Also this project will be relatively simpler and quicker to construct, for which technical expertise and manpower is comparatively more available within the country. It will also help in less dependence on Kaduna river flows which fluctuate greatly. Under the circumstances the Barnawa dam proposal shall be an interesting study for early implementation.

ACKNOWLEDGEMENT

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- The Analysis of the Kaduna Water Supply Distribution System and the Kaduna River Pollution Study (Report), by Louis Berger Incorporated Nigeria, December 1978.
- Kaduna State Water Board Hydro-Meteorological Year Book 1972-1977.