Development of water resources in the Sokoto State

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INTRODUCTION

The Sokoto state is situated approximately between 10^{o}N 14^{o}N latitudes and 4^{o}E and 8^{o}E longitudes. The total area of the state is about 64,000 sq. km. The state is traversed by a number of streams which are tributaries of the Sokoto- Rima system. Sokoto (pop. 141,000) is the seat of state government and Gusau and Birnin - Kebbi are the next two biggest towns. During a period of last ten years, the Sokoto state in general and Sokoto town in particular have experienced a phenomenally rapid development in terms of urban facilities e.g. water supply, roads, housing,etc. Development of water resources in the Sokoto state for water supply and irrigation is briefly described herein.

CLIMATE

The climate varies from hot and dry in the northern part to hot and humid in the southern part of the state. The maximum air temperature usually occurs in the month of April and the minimum in the months of December/ January due to harmattan (ref. 1). The rainy season generally starts in late May or beginning of June in the northern part. The rains end usually towards the end of September. The wettest months are generally August and September. Space distribution of rainfall is shown in the isohyetal map of Fig. 1, (ref. 2). There is only one rainy season with the result that rivers cease to flow soon after the cessation of rains except in the lower sedimentary region of the catchment where rivers receive some base flow from the ground water storage. Some data of pan evaporation at Kwarre is plotted in Fig. 2 and are compared with total water losses (evapotranspiration, seepage, and percolation) from the Wurno reservoir (ref. 1). On the average some 150 - 180 cm depth of water may be lost in evaporation annually from an open lake in Sokoto region.

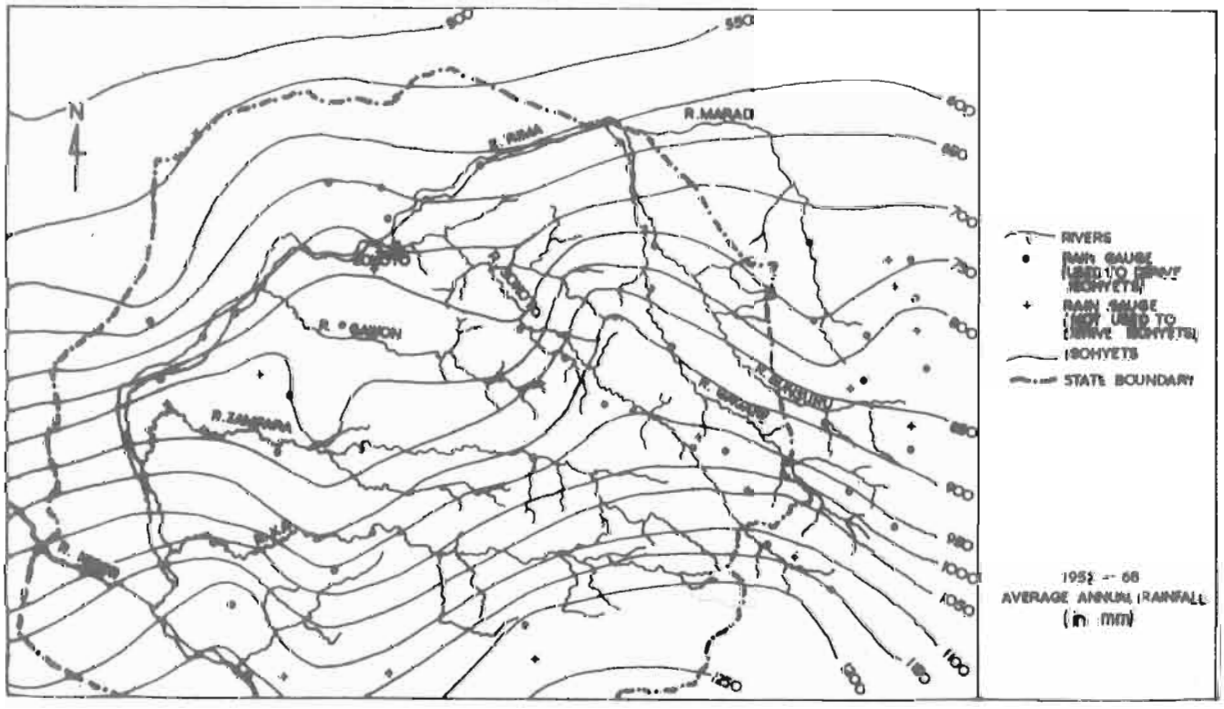

FIG. 1.- Isohyetal map based on average annual rainfall for the period 1952 - 68, after MRT (ref. 2).

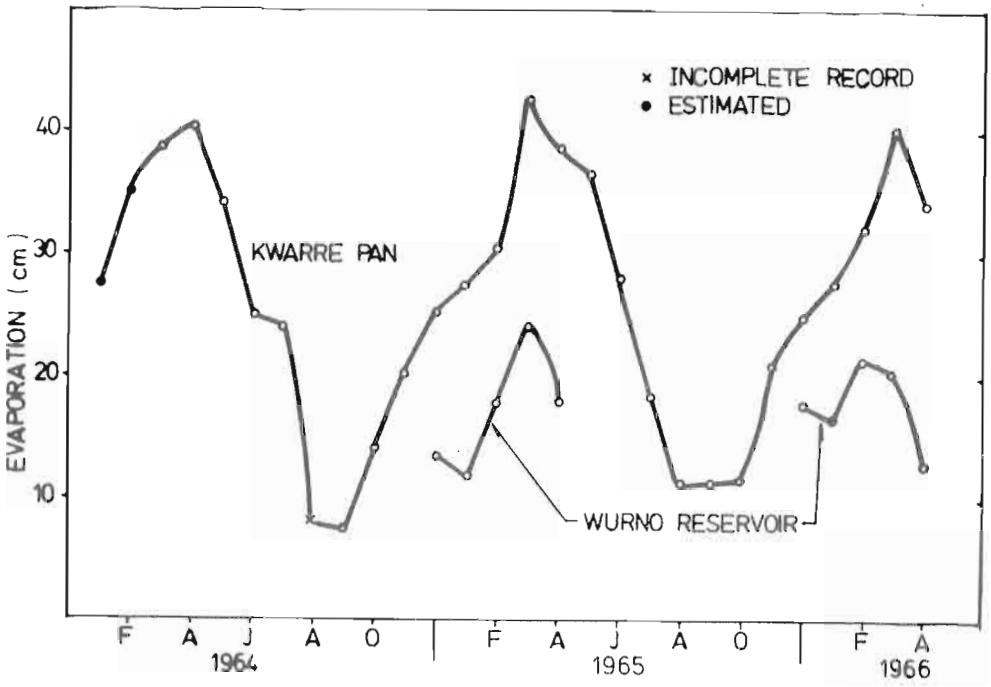

FIG. 2.- Pan evaporation at Kwarre compared with total water losses at Wurno reservoir.

WATER SUPPLY DEVELOPMENT

Geologically the state is divided into two parts by a line running from the north east to south west, Fig. 3 (refs. 1,3). The area to the right of the divide line is underlain by the basement complex which consists of gneisses, granites, phyllites, and quartzite. These rocks are covered by weathered lateritic rocks which usually store some water which is tapped by boreholes for water supply. The yield is uncertain and fluctuates during the year. More dependable source of water supply is the surface storage such as the reservoirs at Kaura Namoda, Gusau, Zuru, etc.

The area (about 40,000 sq. km.) to the left of the divide line is composed of thick sedimentary deposits and is capable of holding large quantity of water. Although the actual quantity of ground water in the sedimentary region is still undetermined, it is sufficient to provide for the water supply of urban and rural areas at many places.

Before 1970, urban water supply schemes existed only at Sokoto, Gusau, Birnin Kebbi, and Yelwa. A treatment plant of about 16.0 million litres/day capacity was built only in 1968 at Sokoto; well points in the river bed were used as source of water supply before 1968. A reservoir across the Koram Wanke stream was built around 1970 in Gusau and a treatment plant of 6.8 million litres/day in 1972. The water supply in Birnin Kebbi was based on five artesian boreholes capable of producing 900,000 litres/day. The water required no treatment and was the only water supply system which was of good quality in the Sokoto state before 1965. A primitive treatment plant without any filters of 22,700 litres/hour capacity existed in Yelwa. The network is now extended to twelve other towns, Fig. 3. Only a few schemes which could be described as semi- urban existed before 1970. A vast network has now been developed in the state which includes 45 semi- urban schemes in addition to 16 urban water supply schemes, Fig. 3. Many more (around 100) boreholes have been drilled in rural areas where water is available at stand pipes. At other places, dug wells provide water for domestic use. Some small surface storage schemes also exist at some places which were developed primarily for the use livestock but nonetheless provide raw water for domestic use as well. Table 1 gives the capacities of the urban water supply schemes in the state.

TABLE 1.- Capacities of urban water supply schemes in million litres /day.

Station	Capacity	Station	Capacity
Sokoto	32	Argungu	1
Birnin Kebbi	14	Yelwa	5
Gusau	14	Zuru	5.2
K- Namoda	2.5	Koko	1.2
Gwadabawa	1.2	Shinkafe	1.2
Jega	1.2	Kamba	1.2
Tambawal	1.2	Anka	1.2
Talata-mafara	1.2	Gummi	1.2

The average yield of boreholes is 9,000 - 11,000 litres/ hour, the maximum being upto 16,000 litres/ hour. Most of the boreholes are drilled upto a depth of 35 m or so. One of the boreholes in Sokoto town was drilled upto a depth of 120 m with an exceptionally high yield of 45,000 litres per hour. The borehole was abandoned because it contained a heavy content of iron requiring additonal facility for oxidation. The demand is

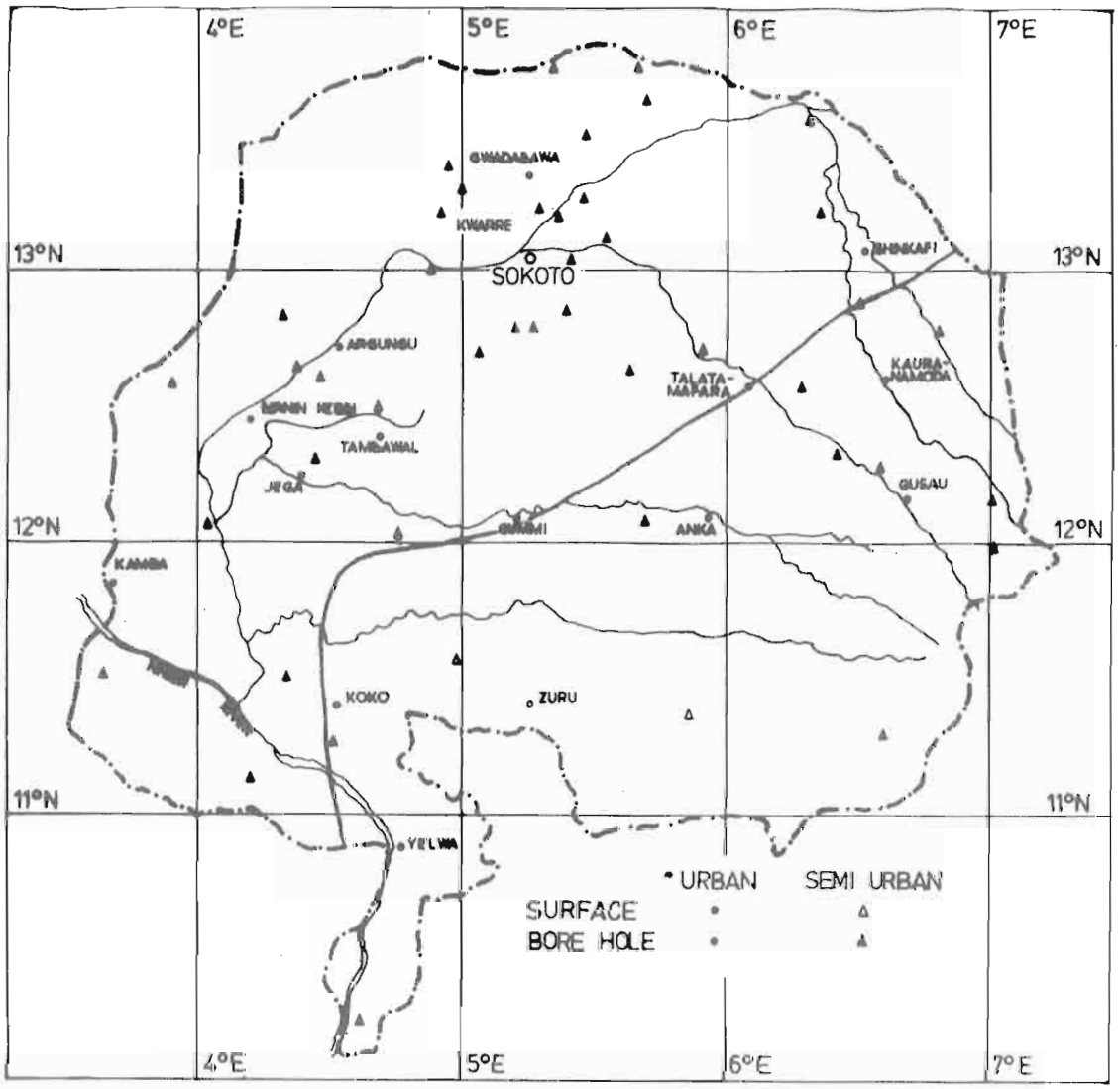

FIG. 3.- Location of urban and semi- urban water supply schemes.

easily met by other shallow boreholes where quality of water is good. The quality of borehole water in general is good excepting the Argungu borehole where iron content is in the range of 4 - 5 ppm. A facility for oxidation is provided there in order to reduce the iron content. Treatment plants are provided where the source of water is natural rivers and streams.

IRRIGATION DEVELOPMENT

Before 1970, a number of minor irrigation schemes were developed in the state, ranging only from 2.5 hectares to 250 hectares. Some of these schemes were pump lift while others were based on gravity flow principle. One of the largest of such schemes was at Wurno where a reservoir was created by building earthen dikes along a natural ridge in the fadama. The total area suitable for irrigated agriculture was around 250 hectares of which nearly half was developed around 1970.

In order to develop large scale irrigation schemes in the state, a basin wide survey of soil and water resources was undertaken by the regional Government of Northern Nigeria around 1961 in colloboration with the Food and Agricultural Organisation (FAO) of the United Nations. A comprehensive report was compiled by the FAO which located a number of prospective dam sites and identified suitable areas for irrigated agriculture. Based on the recommendations of the FAO, the Bakolori dam has now been constructed across the Sokoto river, Fig. 4, near Talatamafara. A number of irrigation canals and structures has been built for the application of irrigation water on the farm land in the development area. A total area of nearly 12,000 hectares is envisaged to be developed by irrigated agriculture. All the different types of soils e.g. heavy clayey soils in the fadama and the open textured soils in the upland, will be developed using gravity and sprinkler systems of irrigation. Lift irrigation will also be developed where required. The Bakolori scheme will not only enhance the national agricultural production but will also provide the much needed training in irrigation practices. This will prove immensely useful for developing future irrigation schemes.

Work is about to start on the construction of Goronyo (Kachera) dam across the Rima river,

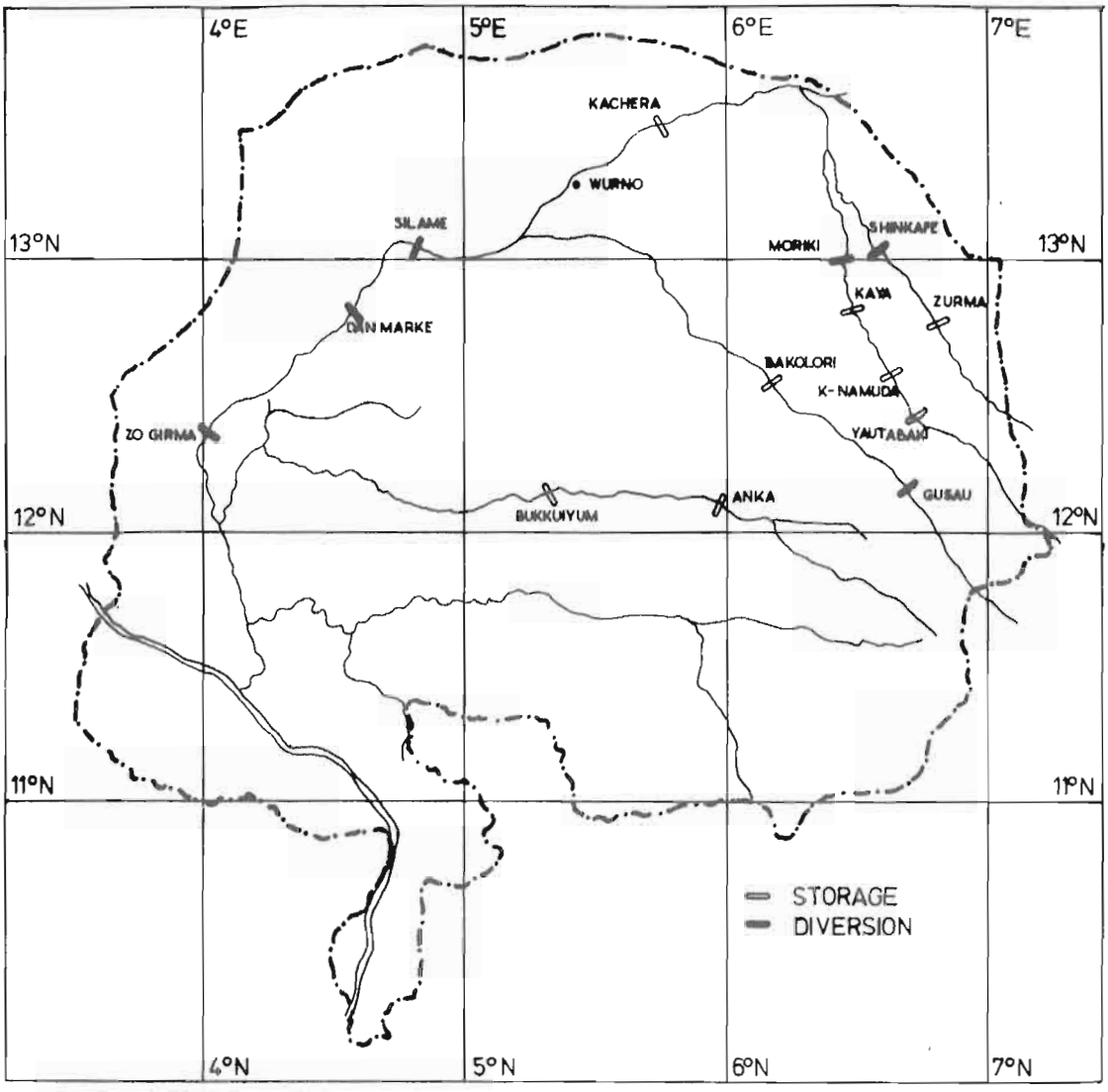

FIG. 4.- Proposed locations of storage and diversion dam sites, after FAO (ref. 4). Open rectangles denote storage dams and the black ones the diversion dams

Fig. 4. The various sites for storage and diversion dams proposed by the FAO are shown in Fig. 4 and their reservoir capacities are given in Table 2.

TABLE 2.- Proposed dam sites and reservoir capacities in the Sokoto- Rima Valley.

Site	River	Capacity m^3
Zobe[@]	Gagere	37,300
Zurmi	Gagere	8,500
Yautabaki	Bunsuru	35,300
Kaura- Namoda	Bunsuru	27,300
Kaya	Bunsuru	21,000
Kachera	Rima	57,000
Gusau	Sokoto	14,800
Bakolori	Sokoto	42,000
Anka	Zamfara	9,900
Bukkuyium	Zamfara	24,700

[@] In Kaduna state.

There may be modifications in the FAO proposals at the time of actual execution of these projects. In due time, the agricultural production of the state will be greatly enhanced when the proposed projects are implemented.

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