

**BASIC DESIGN STUDY REPORT  
ON THE PROJECT FOR  
GUINEA-WORM ERADICATION AND  
RURAL POTABLE WATER SCHEME (PHASE-II)  
IN  
THE FEDERAL REPUBLIC OF NIGERIA**

**OCTOBER 1989**

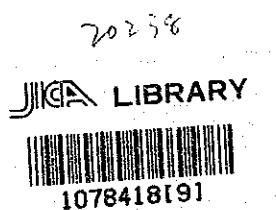
**JAPAN INTERNATIONAL COOPERATION AGENCY**

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## PREFACE

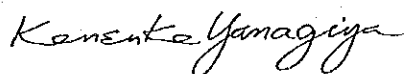
In response to the request of the Government of the Federal Republic of Nigeria, the Government of Japan has decided to conduct a Basic Design Study on the Project for Guinea-Worm Eradication and Rural Potable Water Scheme (Phase-II) and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Nigeria a survey team headed by Mr. Satoshi Abe, Grant-Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, from July 9 to August 12, 1989.

The team exchanged views on the Project with the officials concerned of the Government of Nigeria and conducted a field survey in the Project area. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Federal Republic of Nigeria for their close cooperation extended to the team.

October, 1989

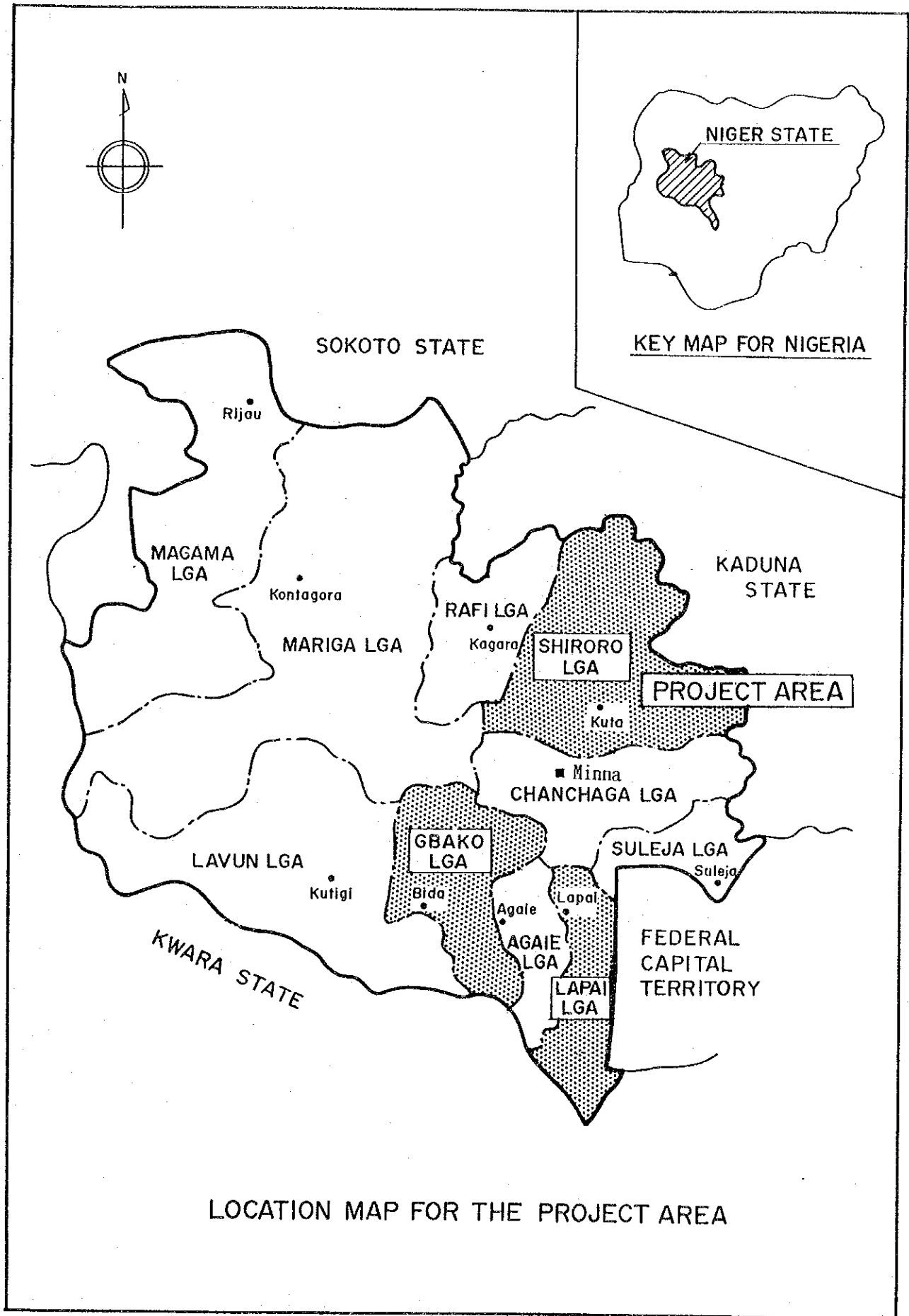


Kensuke Yanagiya

President

Japan International Cooperation Agency











Water Source for Villagers.



Guinea - Worm Disease.



Guinea - Worm coming out from the skin.





Posters for Educational Activities.



Pit for Vehicles.



Borehole  
Constructed by  
WATSAN Project.



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## ABBREVIATIONS AND SYMBOLS

DEFRRRI	:	The Directorate of Foods, Roads and Rural Infrastructure
G-W	:	Guinea-worm
PVC	:	Polyvinyl Chloride
WATSAN	:	UNICEF-assisted Water and Sanitation Programme
UNICEF	:	United Nations International Children Emergency Fund
GDP	:	Gross Domestic Product
UNDP	:	United Nations Development Program
OPEC	:	Organization of Petroleum Exporting Countries
SAP	:	Structural Adjustment Programme
WHO	:	World Health Organization
LGA	:	Local Government Area
WATSAN	:	Rural Water and Sanitation Programme
NGO	:	Non-Governmental Organization
FMOH	:	Federal Ministry of Health
Global 2000	:	Technical Assistant Group for Developing Countries Organized by former President Carter
PH	:	Index of Hydrogen Ion
ohm-m	:	Specific Resistivity
mhos/m	:	Unit of electrical conductivity, unit: Micro mhos per metre



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## S U M M A R Y

The Federal Republic of Nigeria (hereinafter referred to as "Nigeria") is an agricultural country as well as an oil producer and is a member of OPEC. It has a population of over one hundred million, which is equivalent to one-fourth of the total population of Africa. After independence, Nigeria suffered from the continuous fall in oil prices caused by the world recession in the 1980's, which resulted in an insufficient foreign currency reserve; thus, seriously affecting the economy of the country. The Government of Nigeria had been carrying out a policy of national economic revival in its 4th National Development Plan (1981-1985) which was followed by the Structural Adjustment Programme (1985- ).

In the Programme, the water supply improvement project for national health and hygiene by Directorate for Food, Roads and Rural Infrastructures is one of the top priorities. The two main objectives of the water supply improvement project of the National Development Plan are: (1) to install a communal water tap within 200 m of all households in the urban areas, and (2) to considerably shorten the time required for securing potable water in the rural areas. The supply of safe water to rural areas also aims at the eradication of Guinea-worm disease which is caused by the shortage of safe drinking water in the country.

It is estimated that over 2.5 million people are infected by Guinea-worm disease in Nigeria. The Guinea-worm is a nematode parasite that infects human beings. The larvae parasitize cyclops (water fleas) inhabiting stagnant water such as pond water, enter the human body when such water is drunk, grow into imagoes (mature worms) in about one year, and come out of the human body by piercing mainly the skin of the lower legs. The infected person feels intolerable pain 3 to 4 weeks until the worm comes out of his body.

Based on the case studies conducted by the State Ministry of Health and JICA Study Team, 10 to 20% of the population is infected by Guinea-Worm in the eastern part of the Niger State. Also a study of Sokoto University has revealed that more than 80% of the population is infected by the Guinea-Worm in a village of the northern part of Shiroro LGA where proper potable water sources were not found.

Since Guinea-worm disease is caused by drinking unsafe water from pond, etc., it can be completely eradicated if safe potable water can be secured for the people, and this fact has been confirmed by the UNICEF-Assisted Project in the Kwara State and the JICA's case studies in three villages in the Shiroro and Lapai LGAs.

In order to eradicate Guinea-worm disease, the government of Nigeria has programmed National Plan of Action to eradicate the disease by December 1995. The State Task Force has been settled in the State Ministry of Health in June, 1988 with the following eradication programme: (1) health education, (2) provision of safe potable water, and (3) chemical control of drinking water. For the supply of safe water, only the UNICEF-assisted Rural Water and Sanitation Project (hereinafter referred to as the "WATSAN Project") is bearing a part of the programme since 1987.

To improve health and water supply condition of rural people, the Government of Nigeria has requested grant-aid from the Government of Japan for construction of boreholes in the Shiroro, Lapai and Gbako LGAs in the Niger State, and procurement of the equipment and materials required for this construction works to cooperate with WATSAN Project.

In 1988, the Japanese grant-aid for Guinea-worm Eradication Project was extended to the Government of Anambra State, Nigeria. Subsequently, a grant-aid for Phase II (Niger State) of the said Project has been requested by the Government of the Federal Republic of Nigeria.

After examining the request, the Government of Japan decided to conduct a Basic Design Study of the Project, and JICA sent a Basic Design Study Team to Nigeria from July 9 to August 12, 1989.

The objectives of the study were to analyze the background and feasibility of the plan, and to conduct the necessary field surveys to determine the optimal scope of the Project.

The Study Team conducted field surveys in Lagos (the national capital), Minna (the state capital) and Shiroro, Lapai and Gbako LGAs in the Niger State, and held a series of discussions with the authorities concerned of the Government of the Federal Republic of Nigeria.

The Study Team has concluded that 150 boreholes with handpumps and the supply of equipment and materials for their construction are urgently required for securing safe drinking water from groundwater sources to relieve the three Local Government Areas, Shiroro, Lapai and Gbako, located in the eastern part of the Niger State from serious infection and Guinea-worm disease.

Also, it has been judged that the transfer of knowledge related to planning, design, site selection, drilling and construction supervision of boreholes to the Nigerian staff will also be indispensable in this Project.

The outline of the Project, and the major equipment and materials to be supplied for the Project are as follows:

Outline of the Project

<u>Number of Objective LGA</u>	<u>Number of Villages</u>	<u>Population</u>	<u>Benefited Boreholes</u>	<u>Population</u>
Shiroro	34	225,300	50	22,500
Lapai	48	99,200	50	22,500
Gbako	17	449,500	50	22,500
<b>Total</b>	<b>99</b>	<b>774,000</b>	<b>150</b>	<b>67,500</b>

Major Equipment and Materials

<u>Items</u>	<u>Quantity/Unit</u>
1) Drilling rig with high pressure compressor and accessories	2 units
2) Supporting vehicles	14 units
3) Supporting equipment	2 lots
4) Borehole development and pumping test equipment	2 lots
5) Drilling fluid additives	1 lot
6) Casings and screens	1 lot
7) Handpumps	173 Numbers
8) Geophysical equipment (resistivity and electro-magnetic)	1 each
9) Water quality analysis kit	2 lots
10) Workshop tools	1 lot
11) Spare parts	1 lot

When the Project is executed under Japanese grant-aid, the undertakings/responsibilities of the two Governments will be as follows:

The Undertakings of the Government of Japan:

- \* Selection of borehole sites.
- \* Construction of 150 boreholes equipped with handpumps.
- \* Supply of equipment and materials required for the construction of the above boreholes.
- \* Design and supervision for procurement and construction.
- \* Transfer of technical knowledge to Nigerian staff during the construction stage.

The Undertakings of the Government of Nigeria:

- \* Deployment of Nigerian personnel and budgetary arrangements for implementation of the Project.
- \* Efficient operation and maintenance of the granted equipment and water supply facilities to be constructed.

In addition to the grant-aid to be provided by the Government of Japan, the Government of Nigeria shall make budgetary arrangements amounting to Four Hundred and Thirty Thousand Naira for construction, and Eight Hundred and Sixty-One Thousand Naira for operation and maintenance for a period of ten (10) years after the completion of the borehole construction.

The Project will be commenced after the Exchange of Notes (E/N) between the two Governments is concluded.

The Project is scheduled into two stages and to be completed in 31 months after E/N for the Stage-1 including all the necessary steps such as the conclusion of a consultant agreement, detailed design, tendering, conclusion of contracts for procurement and construction, procurement and transport of equipment and materials, and the construction of 150 handpump equipped boreholes.

The Project will be implemented by the Ministry of Health, Niger State. After the completion of the Project, the benefited local people, under the guidance of the WATSAN Project Office will conduct daily operation and maintenance of the constructed water supply facilities.

By providing potable water, this Project will directly contribute the eradication of Guinea-worm disease and other diseases carried by drinking water, and thus improve and maintain the health and hygiene of the people.

As for the social benefits, the Project will help reduce the time and labor force required for securing safe drinking water since water source facilities are provided close to the communities. The time and labor force saved could be used for domestic chores and agricultural production activities.

Besides such direct benefits, knowledge related to the construction, operation and maintenance of water supply facilities will be transferred to the Nigerian staff through the implementation of the Project, and will enable them to conduct the construction of similar facilities in the future.

From the above facts, it is concluded that grant-aid cooperation for the Project is justifiable from both the technical and financial points of view.

The following would be recommended to the Government of Nigeria as a result of the Basic Design Study for the Project:

- (1) The beneficiaries of this Project would not include the entire population in the Project Area since the Project is implemented preferentially in the most urgent areas. It is, therefore, essential to continue similar construction work to supply potable water to all the remaining people so as to eradicate Guinea-worm disease in the area.
- (2) Provision of an appropriate staff and budget is necessary for the effective utilization of the granted drilling rigs and associated equipment.

In order to carry out the operation and maintenance of the water supply facilities to be constructed under the Project, it is also important to establish closer cooperation with the WATSAN Project Office.





## CHAPTER 1. INTRODUCTION

In Niger State of the Federal Republic of Nigeria, the water supply situation in the rural areas needs to be consolidated, although the urban areas are relatively well equipped with water supply facilities.

In particular, in Shiroro, Lapai and Gbako LGAs, situated in the eastern part of Niger State, the water supply service level is very low, with only about eight percent of the service supplied by water taps.

The sources of drinking water are mainly the stagnant water of artificial ponds or stream water. The water from these sources is poor in quality and causes a high occurrence of water-borne diseases, especially Guinea-worm infection.

Ten to twenty percent of the village people, mostly children and farmers, suffer from dracunculiasis yearly, which fact seriously influences the agriculture-dependent economy of the region.

In order to improve these conditions, the Government of Nigeria planned the Guinea-worm Eradication and Rural Potable Water Scheme (so-called Borehole Project) and requested grant-aid from the Government of Japan to urgently construct 150 boreholes in 3 Local Government Areas (LGAs) in Niger State, including the supply of two sets of drilling rigs and the supporting vehicles required for carrying out the scheme.

After examining the request made by the Government of the Federal Republic of Nigeria, the Government of Japan decided to conduct a Basic Design Study on this Project, and has entrusted the study to the Japan International Cooperation Agency (JICA).

JICA dispatched the Study Team led by Mr. Satoshi Abe, Grant-Aid Cooperation Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, to Nigeria to conduct the study from 9 July to 12 August, 1989.

The Study Team held a series of discussions and conducted field inspections and exchanged views with the authorities concerned of the Governments of Niger State and the Federal Republic of Nigeria.

Matters basically agreed upon during the discussions between the Study Team and the Nigerian authorities are recorded in the Minutes of Meetings signed on 4 August, 1989 by both representatives.

## CHAPTER 2. BACKGROUND OF THE PROJECT

### 2-1. General Conditions in Nigeria

The Federal Republic of Nigeria gained its independence from the Great Britain in 1960. The continued military coup d'état and Biafuran war influenced by the tribal confrontation broke out after independence, and the country had not experienced any form of political stability for a long time.

Since the present Babangida Military Government was established in 1985, the government has been stabilized and is setting economic reconstruction of the country as the main theme.

The country is situated between 3 to 15 degree east longitude, and 4 to 14 degrees north latitude. It stretches for 1,300 km and 1,100 km in east-west and north-south direction, respectively. It covers an area of 924 thousand square kilometers.

It has a population of 100 million or one-fourth of that of Africa and is one of the largest countries in the African continent.

Nigeria adopted federalism and consists of 21 states at present; all states had its own government.

It is one of the biggest oil producing countries with a production of 2,400 thousand barrels per day in the '70s. It reached the peak of economic growth in 1979 and 1980. The oil production fell into 1,320 thousand barrels per day in 1987. The dullness of oil business was severe and no substitute was found for export commodities. Reflecting such financial situation, the debt amounted to more than forty percent of the oil revenue (22 billion U.S dollars). International trade balance marked a deficit and rescheduling of budget has been requested based on the arrangement of World Bank and other international financial institutions.

The government expedited international cooperation by adopting non-alignment policy. While Japan has become one of the largest financing countries (U.S\$13.0 million) with a net disbursement of 913 million U.S dollars of actual ODA given to Nigeria by international donor countries in 1986.

The amount of multi-lateral aid was U.S\$20 million, and UNICEF became one of the largest financing organizations (U.S\$7.1 million) in the same year.

The crude oil contributes more than 95 percent of export commodities and the United States, Holland and French contribute largely to import it from Nigeria. The machinery and manufactured goods which are major importing commodities are imported from the United Kingdom, West Germany and France.

A summary of Japanese economic cooperation and trade with Nigeria is shown in Table 2-1.

Table 2-1. Japanese Economic Cooperation and Trade to Nigeria  
(Million U.S \$)

Table 2-1 Japanese Economic Cooperation and trade to Nigeria (million US\$)  
(OECD, 1989)

	1983	1984	1985	1986	1987
Economic Cooperation					
Bilateral					
Grant	1.84	2.47	2.33	2.75	13.09
(Tech. Assist)	1.74	1.38	1.61	2.75	5.63
Loan	15.95	-1.81	-0.61	10.22	4.87
sub total	17.79	0.66	1.72	12.97	17.96
Other Government & Private	51.46	-1.68	33.52	116.02	272.69
Grand Total	69.25	-1.02	35.24	128.99	290.65
Trade					
Export from Japan	567.81	445.52	342.03	194.77	345.99
Import to Japan	6.71	7.01	5.83	5.18	5.26

Note: Other Government & Private include Export credit, Private credit (direct invest., bank sector and grant from NGO)

## 2-2. Summary of National Development Plan

Although the Fourth National Development Plan (1981-1985) has lapsed, the plan was pursued under the programme entitled "the Structural Adjustment Programme (SAP)". The country's development goals under the Fourth National Development Plan are the following:

- 1) Greater self-reliance by achieving optimum utilization of human and material resources.
- 2) Development of technology.
- 3) Increase productivity and reduction of under employment.
- 4) Reduction of rural-urban migration.
- 5) Improvement of habitat through development of working conditions and proper management of environment.

The main targets of the policy in each sector are:

- 1) to reach 7% in actual economic growth;
- 2) to establish self-supporting system on food, putting agriculture as the primary sector;
- 3) to promote domestic manufacturing industry to reduce dependence on the petroleum sector;
- 4) to strengthen economic infrastructure, particularly power, water supply and telecommunications which are at present the bottlenecks to the performance of most sectors of the economy.

The GDP is about 111 billion Naira in 1987. The agricultural sector and petroleum sector occupy 29.6% and 27.4 % of the GDP, respectively. Manufacturing sector occupies only 9.2%. The agricultural sector increase favourably its growth until 1986 but was relatively slowed in 1987. The actual growths of GDP in 1975/1980 and 1980/1987 were recorded at 1.6% and -1.9%, respectively.

### 2-3 Guinea-worm Disease

The following are conditions where the high rate of occurrence of Guinea-worm disease prevail:

- a) In areas where good quality potable water is not available;
- b) In areas where the inhabitants neglect the prevention against Guinea-worm disease;
- c) In areas where countermeasures are not seriously taken to eradicate the Guinea-worm issue.

There are only few patients suffering from Guinea-worm in the urban areas. But in the rural areas, there are about 2.5 million patients per year. And most of them are farmers and their children. The occurrence of Guinea-worm disease by LGA in Nigeria is shown in Figure 2-1.

The figure delineated is based on the nation-wide case study on Guinea-worm in March, 1989. As shown in this figure the effected number of village in the Niger state account only a small in the central part of LGAs in the state, while the rest of LGAs indicate more than 50 effected villages. According to the map prepared by UNICEF in 1987, the eastern part of the state where project is located shows high endemic area of Guinea-worm (see Figure 2-2).

As shown in Figure 2-3, the Guinea-worm infection is summarized as follows:

- i) The mature female worm pierces into the skin causing ulcer.
- ii) When ulcer intrudes into the water, larvae are discharged in the water.
- iii) The larvae infects cyclops, a small crustacean.
- iv) The water, contaminated with the infected cyclops, is consumed.
- v) The ingested larvae matures into the human body within one year.
- vi) The cycle is repeated from the beginning (refer to (i) above).

The Guinea-worm disease is transmitted entirely through drinking water infected by cyclops. It can totally be eradicated if drinking water is cyclops-free.

The total number of patients suffering from water-borne diseases in the Niger State is shown in the table below.

Table 2-2. Occurrence of Water-borne Diseases in the Niger State

(The State Ministry of Health)

Name of Diseases	1986		1987		1988	
	case	death	case	death	case	death
Guinea-Worm	2,000	2	5,000	10	16,812	20
Typoid Fever	200	5	1,000	10	2,000	23
Dysentery	nil	nil	nil	nil	-	-
Intestinal Parasites	50	2	60	-	4	-
Diarrheal Disease	100	-	50	-	30	-
Schistosomiasis	10	-	-	-	40	-
Malaria	500	10	400	20	450	15
Cholera	40	5	30	2	23	2

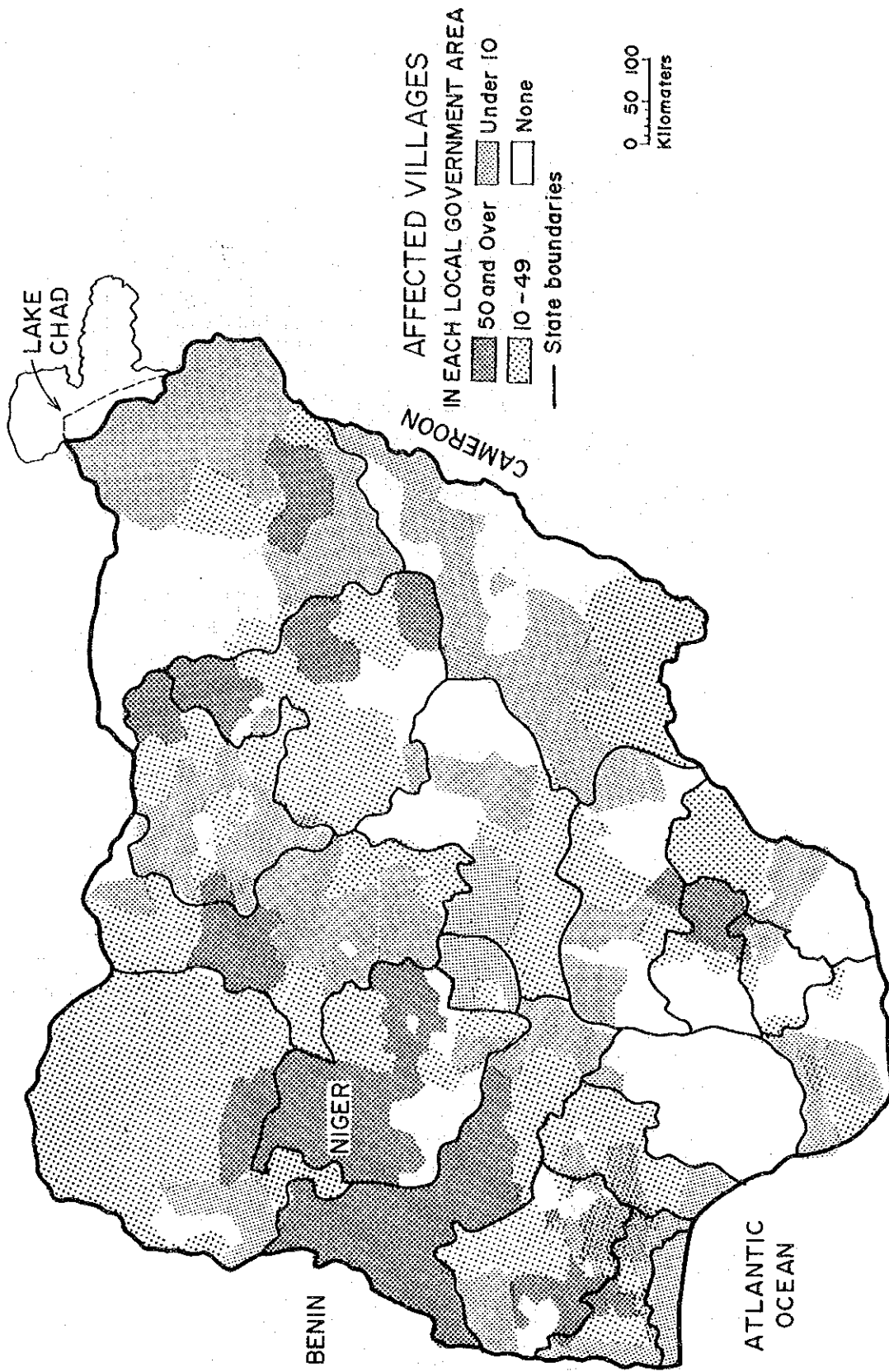
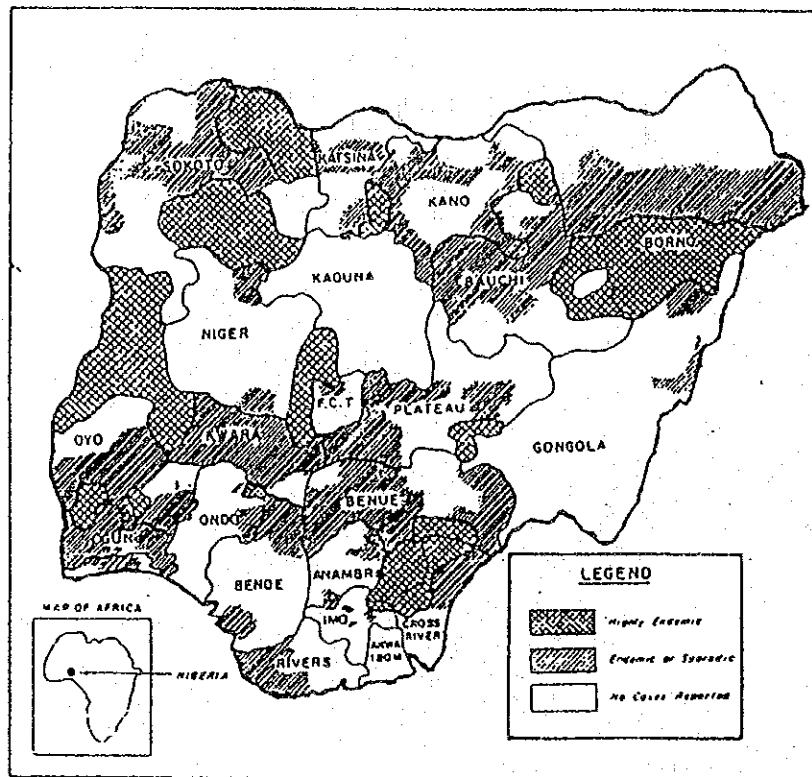


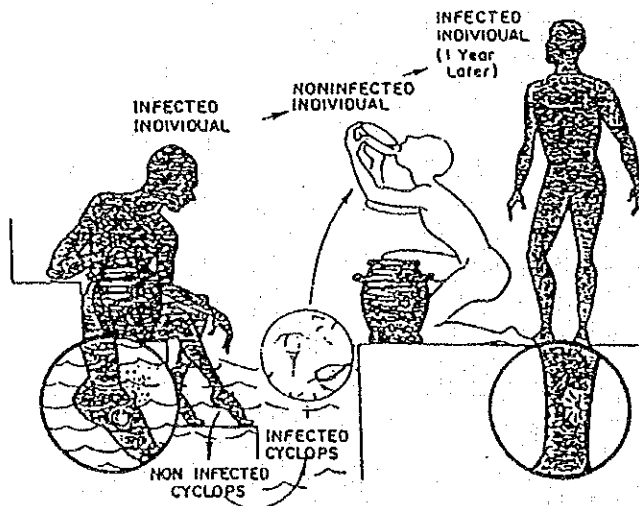
Fig. 2-1. Map of Nigeria showing Guinea-Worm Endemic Area by LGA

FIG. 2-2 MAP OF NIGERIA SHOWING THE DISTRIBUTION OF DRACUNCULIASIS (GUINEA WORM DISEASE) BY STATE



(UNICEF, 1987)

FIG. 2-3 Life Cycle of Guinea Worm



- The mature female worm pierces the skin of the lower leg causing an ulcer
- When the ulcer is in contact with water, larvae are discharged into the water
- The larvae infect Cyclops, a small crustacean
- The water, contaminated with the infected Cyclops, is consumed
- The injected larvae mature in humans in one year

- Guinea-Worm disease is transmitted entirely by drinking water
- The contaminated water is typical from open surface water such as stagnant ponds or "step wells"



## 2-4. Water Supply Situation in Nigeria

### 2-4-1. Present Situation

Provision of safe potable water supply system can contribute to the eradication of Guinea-Worm. In the areas where safe drinking water is available have less incident rate of Guinea-Worm and other water-borne diseases compared with the areas where safe water sources is not available.

As shown in following Table, the situations of water supply in urban and rural areas in Nigeria are very much different. In the rural areas where more than 80% of the population are living, provision of pipe water supply system indicate only 8.1% of the households. Besides pipe water system, boreholes provide safe drinking water compared with shallow dug wells and surface river sources especially stagnant stream which are usually deficient during the dry season

Table 2-3. Water Supply by each Source in Nigeria

	<u>Pipe System</u>	<u>Surface Water</u>	<u>Dug Well</u>	<u>Borehole</u>
Urban area	69.4%	8.6%	16.8%	5.2%
Rural area	8.1	63.3	25.6	3.0

Source: General Household Survey Report, 1984.

Based on household distribution in Nigeria, about 16 million people in the urban areas and 9.6 million in the rural areas in 1987 are provided with safe drinking water, while the remaining 82.7 million people are provided with unsafe drinking water.

Major problems of the water supply sector under the Fourth National Development Plan are as follows:

- \* Inadequate supply and distribution network, and low quality of water.
- \* More serious water problems in the rural areas.
- \* Shortage of funds resulting from inadequate budgetary allocations.
- \* Inability to pursue a meaningful policy or cost recovery which in turn permit more facilities to be provided.
- \* Shortage of technical and supervisory manpower leading to inadequate maintenance and incessant breakdown of water supply systems.

The above problems still remain at present, especially some taps run dry and stay for a long time in the urban areas, while the inhabitants in the rural areas have few facilities.

## 2-4-2. Water Supply Plan in Nigeria

The Niger State Water Board has performed mainly the improvement and expansion of urban water supply systems and villagers in the rural areas are providing water sources by themselves. However, the Directorate for Food, Roads and Rural Infrastructure (hereinafter referred to as "DFRRI") which is organized by the Federal Government in 1985, has constructed boreholes for the rural water supply system.

The fundamental policy of water supply sector under the Fourth National Development Plan period is two-pronged:

- 1) No house will be built more than 200 meters apart from the water tap in the urban centers.
- 2) The time spent in securing water by man-power will be drastically reduced in the rural areas.

In order to achieve these targets, the government will pursue the following policies:

- (1) The institutions that had been established under the State Water Boards will be strengthened, and in some cases will be organized and provided with adequate staff and funds to implement and commission more water projects. In order to improve the finances of the Water Boards, a vigorous cost recovery policy based on reasonable user charges will be pursued.
- (2) Additional sources of raw water will be identified and exploited through the activities of the River Basin Authorities and State Water Boards. This will be done by damming rivers and streams sinking boreholes and in coastal regions by desalinization of sea water.
- (3) The Training School for Assistant Works Superintendent in Kaduna will be expanded to train more of the much-needed manpower in the water supply sector.
- (4) An educational campaign will be mounted, especially in the rural areas, to underscore the value of boiling water in order to improve its quality for drinking purposes as well as to encourage hygienic water storage practices.

- (5) Hydrological investigations will be intensified in order to collect adequate data for further expansion of water resources in the country.
- (6) To ensure a consistent quality of water supply, various State Water Boards will be encouraged to set up water quality control laboratories to monitor the quality of water supplied to consumers.

Although these policies have been continued under the SAP, provision of new water supply facilities in the urban areas would not be extended except the rehabilitation of the existing ones. In the rural areas, although DFRRI has drilled large number of boreholes, most of them can no longer be used due to lack of hydrogeological prospecting and inadequate techniques for borehole completion and pump installation.

The budget allocated for the health and water sources sectors by the Federal Government is shown in Table 2-4. As shown in this table, the capital expenditure for the water sources sector in 1986 is 138 million Naira which is equivalent to 1.5% of total capital expenditure. This expenditure occupies only a small amount of share planned by the Fourth National Development Plan amounting 3.1 billion Naira for five years.

Table 2-4. Federal Expenditures for Health and Water Sources (1981-1987)

SECTOR	1983	1984	1985	1986	1987
Recurrent Expend. Health	5,624.33	7,873.66	8,132.31	9,002.66	5,154.73
(Naira)	161.51	86.96	164.35	247.04	110.90
(%)	2.87	1.10	2.02	2.74	2.15
Water Sources					
(Naira)	216.27	—	—	—	—
(%)	3.85	—	—	—	—
Others					
(Naira)	5,246.55	7,786.70	8,755.62	7,967.96	5,043.83
(%)	93.28	98.90	97.26	97.98	97.85
Capital Expenditure Health	5,874.59	3,812.18	7,613.26	9,076.84	8,029.17
(Naira)	92.95	34.61	59.08	65.17	15.60
(%)	1.58	0.91	0.78	0.72	0.19
Water Sources					
(Naira)	433.54	156.08	170.93	138.11	32.97
(%)	7.38	4.09	2.25	1.52	0.41
Others					
(Naira)	5,348.10	3,621.49	7,383.25	8,873.56	7,980.60
(%)	91.04	95.00	96.98	97.76	99.40
(Economic and Social Statistics Bulletin 1988 Edition, Federal Office of Statistics, Lagos-Nigeria)					

### 2-4-3. National Plan of Action on Guinea-Worm Eradication Programme

#### (1) General

In 1989 the first National Conference on Dracunculiasis was held in which it was confirmed that the disease is endemic in all states of the country except the Federal Capital Territory.

In June 1988 the Secretariat of Task Force on National Plan of Action for Guinea-Worm Eradication Programme was established in the Federal Ministry of Health based upon the declaration by the Government at the second African Conference in Ghana in March 1988 with a budgetary assistance from Global 2000, an organization established by former President of the United States, Jimmy Carter.

The goal of this programme is to eradicate the Guinea-worm diseases in Nigeria by December 1995.

## (2) Eradication Programme

The eradication programme is as follows:

- \* Completion of the first active search on nationwide basis and repeat the search every year on LGA basis on an annual basis by LGA level. : by March 1,
- \* Establishment of at least one health education workshop per year for Guinea-worm eradication. : by June 30, 1990
- \* Implementation of health education in all known endemic villages. : by Dec. 31, 1990
- \* Distribution of filters to each household in all endemic village where has no safe water source. : by July 1, 1991
- \* Eradication of Guinea-worm in states with low endemicity. : by Dec. 31, 1991
- \* Eradication of Guinea-worm in states with moderate endemicity. : by Dec. 31, 1993
- \* Eradication of Guinea-worm in states with high endemicity. : by Dec. 31, 1995
- \* Monitoring the occurrences of the Guinea-Worm disease. : until 1997.

## (3) Components of Eradication

### a) Health Education

Health education shall be directed at village basis that Guinea-worm comes from drinking water sources and all drinking water source should be filtered or boiled.

In Burkina Faso, health education was executed to promote the use of a filter for drinking water to reduce transmission of Guinea-worm. The prevalence in three villages declined from 24-54% to 0% within two years after execution of the education.

The use of filters has an advantage that families could protect themselves through self-help. Therefore, it is required to provide low-cost and durable filters to the users..

Boiling water is very effective and it kills germs besides Guinea-worm but this method is not widely popular due to its scarcity and high cost of firewood.

#### b) Provision of Safe Water

Guinea-worm disease can be completely eradicated by the supply of safe drinking water. Filters are a good alternative measure until the provision of safe water source for the eradication of the disease. However, this method could not be realized in the villages due to insufficient health education.

Provision of the borehole would be the best solution to obtain safe drinking water. However, budget for provision of boreholes is a big problem. Safe water supplies have been very effective when implemented; in one study it reduced the prevalence in three villages in, Kwara State from a prevalence of greater than 50% to 0% within three years. Provision of safe water in/near village has multiple effect, especially upon the lives of women and children; a frequent water collection for traditional water sources is a time-and-energy-consuming task, and a recent study revealed that this activity is predominantly undertaken by women (49%) and children above 5 years old (37%).

#### c) Chemical Treatment of Drinking Water

Chemical vector control with Temephos may be used to help rapidly control of transmission in some areas. This control will probably be not more than 10% of all endemic villages.

#### (4) Financial Requirements for Eradication Programme

Financial requirement for Guinea-worm eradication is calculated in Table 2-5 based on the following assumption. As is shown in the table, foreign currency requires 46 million U.S dollars, out of the total 110.45 million U.S dollars reserves.

- \* Target population: 10 million people
- \* Number of villages: 6,000 nationwide
- \* Average village population: 1,667 people
- \* Average household size: 9 people
- \* Average number of households per village: 18
- \* Health education and distribution of filters should be used to all effected villages;
- \* Safe water supply is the ultimate objective for all effected villages; and,
- \* Chemical vector control option should be reserved for special situation.

#### (5) Potentially Available Resources

All of agencies and Projects concened to the rural water supply seetor are not perfectly contributing to the eradication of Guinea-Worm disease. Potentially available resources including these agencies is summarized in Table 2-6.

Table 2-5. Cost of Integrated Package for Guinea-Worm Eradication Programme  
(Million US\$)

INTERVENTIONS	1990	1991	1992	1993	1994	1995	Total
HEALTH EDUCATION	10.0	9.00	7.00	5.00	2.50		33.50
	2.00	1.80	1.40	1.00	1.25		17.45
WATER SUPPLY	1.00	2.00	2.00	2.50	2.50		10.00
	10.00	20.00	20.00	25.00	25.00		100.00
CHEMICAL CONTROL	1.00	1.00	1.00	1.00	1.00	1.00	6.00
	0.50	0.50	0.50	0.50	0.50	0.50	3.00
TOTAL COST	12.50	22.30	21.90	26.50	26.75	0.50	110.45

Upper figures : Population in million

(Source : Global 2000, March, 1989)

Lower figures : Cost in million US\$

Table 2-6 Potentially Available Resources for Guinea-Worm Eradication Programme.

(Million of US\$)

AGENCY	1990-1995 Input	Assumed % Guinea Worm Eradication	Total Allo. Guinea Worm Eradication
World Bank	300.00	7.00	21.00
UNDP	2.00	15.00	0.30
UNICEF	8.00	25.00	2.00
Global 2000/BCCI	1.20	100.00	1.20
JICA	6.00	100.00	1.20
FMOH	0.20	100.00	0.20
DFRRI	27.50	25.00	6.87
State Government	10.10	25.00	2.53
Local Government	22.80	7.00	1.60
NGOs	1.00	100.00	1.00
TOTAL	378.80	11.27	42.70

(Source : Global 2000, March, 1989)

As is shown in the above table, it can be assumed that potentially available financial resources amount to US\$42.7 out of the total US\$110.45. The balance of US\$67.75 may come from World Bank, UNDP, DFRRI, etc. to further accelerate the provision of potable water in Guinea-worm effected areas.

## 2-5. Water Supply Situation in the Niger State

### 2-5-1. General Situation

While the situation of water supply in urban areas are comparatively good as well as in other state, however, the situation in rural areas is very poor.

The State Water Board has performed the improvement and expansion of water supply systems with communal taps in urban areas, especially in State Capital, Headquarter of LGA, and major towns with more than 20,000 population. Water supply in urban areas covers about 50% of their population.

Villages living in the rural areas where there are no facilities provided can obtain potable water from streams, ponds and dug wells. Most of these sources are oftenly used during the dry season. The Water Board has provided boreholes in the villages with more than 20,000 population in the past, however, most of them can not be used because of troubles on the handpumps and water tables below pump sunction are low.

Although DFRRI has performed borehole drilling to provide safe water in the rural areas since 1985, most of them are not functioning at present, due to improper techniques of borehole completion, pump installation without consideration of seasonal water level fluctuation, siting without proper hydrogeological investigation.

UNICEF-assisted WATSAN Project has commenced borehole drilling in three LGAs in 1987. It is a beginning of the full-scale rural water supply project in the Niger State.

Relationship between beneficial population size and implementing agencies is summarized in Table 2-7.



Table 2-7. Water Supply Agencies by Beneficial Population

Residential Category	Population	Type of Tap	Sources	Implementing Agency
Urban	20,000 <	Individual, communal tap	Dam, borehole	Water Board
Semi-Urban	2,000 - 20,000	Point source, communal tap	Borehole, dug well	Water Board, Villagers
Rural	2,000 >	Point source	Borehole, dug well, stagnant water	DFRRI WATSAN Villagers

## 2-5-2 Guinea-Worm Disease in Niger State

### (1) Guinea-worm Disease in the Project Area

The National Task Force on Guinea-worm was inaugurated by the Federal Ministry of Health in accordance with programme on National Plan of Action and performed the nationwide Active Case Study on the disease in October 1988. The study was conducted by the State Ministry of Health in cooperation with the Health Department of LGAs in selected villages and it was comprised of the approximate number of villages in each LGA with Guinea-worm problem, the source of drinking water, health education and availability of the filter. Results of the study in the country and the Niger State is summarized in Tables 2-8 and 2-9, respectively.

As shown in Table 2-8, the study covers 38,462 villages and finds 5,872 effected villages with 653,620 patients, which is equivalent to 15% of the study villages. In the Niger State, especially in the project area of Shiroro, Lapai and Gbako LGAs, the patients account for 10% of the total population. It may be inferred that the estimated patients are about 77,000 out of the total population of 770,000 in the area. Furthermore, the study revealed that a great number of people depend on pond and stagnant surface water for their drinking water based on the results of the field survey conducted by JICA Study Team.

The JICA Study Team revealed that only 8 villages are utilizing safe drinking water by boreholes out of 95 villages surveyed, which is equivalent to 8.5% of the total population. This shows that more than 90% of villagers in the Project area are susceptible to Guinea-worm infection.

Table 2-8 Results of Case Study on Guinea Worm

## NIGERIAN GUINEA WORM ERADICATION PROGRAMME

First Active Case Search Results  
(for epidemiological reporting period 1 July 1987 -30 June 1988  
as reported by the 21 states and the FCT -Abuja, 31 July 1989)

State	No. of Endemic / Total LGAs	No. of Endemic / Total Villages Visited	No. of Cases	Population at Risk <sup>2</sup>
1. Abuja (FCT)	2/3	36/417	1,405	N.A.
2. Akwa Ibom	0/10	0/2,860	0	0
3. Anambra	10/23	872/1,600	175,432	1,520,114
4. Bauchi	16/16	537/1,154	13,197	N.A.
5. Bendel	6/19	19/380	218	39,827
6. Benue	8/12	146/N.A.	38,317	185,513
7. Borno	12/18	188/1,701	5,246	348,475
8. Cross River	5/7	71/1,403	10,959	157,258
9. Gongola	11/17	59/847	319	383,896
10. Imo	10/21	262/3,061	53,668	230,399
11. Kaduna	6/7	76/526	211	259,887
12. Kano	18/20	338/1,570	12,987	1,311,211
13. Katsina	6/7	182/866	12,018	2,000,000
14. Kwara	11/12	1,005/4,682	50,356	2,600,000
15. Lagos	7/8	14/505	41	6,558
16. Niger	9/10	336/1,268	16,812	2,008,884
17. Ogun	10/10	226/4,792	2,933	113,009
18. ONdo	17/17	308/3,250	197,391	1,605,876
19. Oyo	22/24	632/4,274	16,576	914,844
20. Plateau	7/14	67/N.A.	11,813	373,970
21. Rivers	4/10	23/473	295	65,334
22. Sòkoto	18/19	482/2,833	33,366	647,698
<b>TOTALS</b>	<b>212/304</b>	<b>5,879/38,462<sup>1</sup></b>	<b>653,620</b>	<b>N.A.<sup>3</sup></b>

<sup>1</sup>At the time of printing, data were not available on total villages visited for two states.

<sup>2</sup>Population of endemic villages.

<sup>3</sup>No total was provided as there is great variation in the methods used for determining population at risk.

(National Plan of Action, Federal Ministry of Health, 1989)

Table 2-9 Results of Case Study on Guinea Worm in the Niger State  
Surveyed, Oct. 1988

LGA / DISTRICT	RESULTS				TOTAL LGA (1988 Estimation)		
	No village	Population	Patient	G-W%	Population	Patient	G-W%
SHIRORO					225,327	10.0	22,533
GALKOGO	12	6,550	787	12.0			
KUTA	22	6,818	516	7.6			
Sub Total	34	13,368	1,303	9.7			
LAPAI					99,186	8.0	7,935
GULU	20	20,635	1,349	6.5			
LAPAI	28	20,788	2,068	9.9			
Sub Total	48	41,423	3,417	8.2			
GABAKO					449,451	11.0	49,440
BADEGGI	8	1,425	311	21.8			
LEMU	5	2,970	180	6.1			
Sub Total	13	4,395	491	11.2			
TOTAL	95	59,186	5,211	8.8	773,964	10.3	79,907

(Ministry of Health, The Niger State)

Table 2-10 Results of Case Study on Guinea Worm by the Suddy Team

LGA/VIL	Population	Sources	Safty Sources	Patients	G-W%
SHIRORO TAWALI	1,000	Ponds, Dug Wells Boreholes	Ponds, Dug Wells Boreholes	0	0
GWADA				0	0
KUKAWU	500	Stagnant water	none	100	20
FUKA	250	Ponds, Dug Wells	none	50	20
BOLADNA	3,000	S.W., Dug Wells	none	2,500	83
UNGWAN K	750	Stagnant water	none	700	93
ERENA	5,000	S.W., Dug Wells Boreholes	Boreholes	1,500	30
KATO	2,000	Stagnant water	none	0	0
GAWA	1,000	Stagnant water	none	0	0
MAILO	3,000	S.W., Dug Wells	Dug Wells	1,500	50
SHAKWATA	8,000	Ponds, Dug Wells Boreholes	Boreholes	3,000	38
Sub Total	24,500			9,350	38
LAPAI					
DOBOGI	2,000	S.W., Dug Wells Boreholes	Dug Wells, Boreholes	0	0
KPADA	500	Stagnant water	none	0	0
EGBA		Ponds, Boreholes	Boreholes	0	
DUMA	2,000	Ponds, Dug Wells Boreholes	Boreholes	0	0
TAKUTI	5,000	Ponds, S.W., Dug Wells, Boreholes	Boreholes	200	4
Sub Total	9,500			200	2
GBAKO					
LAFIAGI	3,000	Stagnant water	none	10	0
BADEGGI	4,000	Ponds, Dug Wells	Dug Wells	200	5
KATAERIG	5,000	Ponds, Dug Wells	none	300	6
GBAMGBA	3,000	Ponds, Dug Wells	none	150	5
KOLOGA	2,000	S.W., Dug Wells	none	100	5
Sub Total	17,000			760	4
TOTAL	51,000			10,310	20

Note: S.W. = Stagnant Water

(The Study Team, 1989)

Table 2-11. Results of Case Study on Guinea Worm by University of Sokoto

SHIRORO LGA, ERENA BILLAGE

	AFFECTED		NOT AFFECTED		TOTAL	
	NO.	%	NO.	%	NO.	%
1) Patients						
FEMALE	106	35	14	5	120	39
MALE	157	51	29	9	186	61
<b>TOTAL</b>	<b>263</b>	<b>86</b>	<b>43</b>	<b>14</b>	<b>306</b>	<b>100</b>
2) Age						
1 - 10	25	8	30	10	55	18
11 - 20	87	28	4	1	91	30
21 - 30	77	25	1	0	78	25
31 - 40	36	12	2	1	38	12
41 - 50	21	7	2	1	23	8
51 - 60	17	6	4	1	21	7
<b>TOTAL</b>	<b>263</b>	<b>86</b>	<b>43</b>	<b>14</b>	<b>306</b>	<b>100</b>
3) Sources						
STREAM	198	65	31	10	229	75
STAGNANT WATER	65	21	12	4	77	25
<b>TOTAL</b>	<b>263</b>	<b>86</b>	<b>43</b>	<b>14</b>	<b>306</b>	<b>100</b>

SOURCE: AN EPIDEMIOLOGICAL STUDY ON GUINEA WORM INFECTION IN ERENA VILLAGE, USUMANN DANFODIO UNIBERSITY OF SOKOTO : ABBAS SHUAIBU LIMAN, 1989.

The results of the field survey on Guinea-worm infection in the Project area conducted by the study team are summarized in Table 2-10. According to the study, the patients account for about 10,000 out of the population of 51,000. Furthermore, field survey shows that Guinea-worm diseases were totally eradicated in three villages of Tawali and Gwada in Shiroro LGA, and Dobogi in Lapai LGA after the borehole for drinking water have been improved.

An additional Case Study on Guinea-worm disease in Erena village, in Shiroro LGA was conducted by University of Sokoto in 1989 as shown in Table 2-11. The study shows that the patients account for 263 out of total population of 306, or equivalent to 86% of the total villagers. Age of the patients ranges from 10 to 30. The villagers use stagnant surface water for drinking use which is kept in inhabitable places for the cyclops.

## (2) Countermeasures for Guinea-worm Eradication

### - The State Ministry of Health

The Ministry of Health of Niger State puts emphasis on health education and primary health care not only for Guinea-worm eradication but also water-borne diseases. The Health Education and Nutrition Units of the Ministry provides the following eradication programmes:

#### \* Organization

The organization is composed of the secretariat under in the Prevention Section of the Ministry of Health, Zonal Office of Health Education and Village Health Committee in LGAs in cooperation with the State Ministries of Education, information and Local Government, and International Agencies. WATSAN joined the organization since inauguration of the Project in 1987.

#### \* Personnel and Equipment

Health Educator -----	18
Vehicle -----	1
Megaphone -----	1

#### \* Health Education Programme

The programme consists of eradication and primary care of Guinea-worm disease, malaria and epidemic diseases, and family planning by thirty minutes television and radio programmes once a week. Also the educators conduct a tour of all LGAs to perform this programme with a megaphone once every 6 to 10 weeks.

#### \* Training of Health Educator

Promotion of health education to personnel of the Village Health Committee, health workers, and employee of local cafeteria and public food vendor in all LGAs.

#### \* School Programme

The programme consists of basic health education and health technology and gives lectures to teachers of primary school and midwives.

#### \* Control of Epidemic Diseases

Promotion of EPI (Expanded Programme in Immunization) to prevent epidemic diseases such as measles, polio, diphtheria, T.B., pertussis, yellow fever and other epidemic diseases. Promotion of ORT (Oral Rehydration Therapy) to prevent dehydration of infants and children caused by diarrhea.

#### - State Task Force on Guinea-worm Eradication

The Niger State Task Force on Eradication of Guinea-worm was inaugurated in June 1988. The Task Force has a membership of nine drawn from the Health Services Management Board, National Youth Service Corporation, Water Board, DFRRI, Ministry of Information, WATSAN Project Office, Ministry of Local Government, the Epidemiology Unit and Health Education and Nutrition Unit of the State Ministry of Health.

The terms of reference of the Task Force include the following:

- a) Determination of level of Guinea-worm disease.
- b) Identification of the endemic areas in the State.
- c) Recommendation to government the effective measures to be taken in controlling the disease in the state.

For this purpose, the State Government has released a budget for the Task Force Secretariat an amount of 53,626 Naira. The Task Force conducted a tour of all LGAs for the Case Study on Guinea-worm. Results of the study are summarized in the section 2-5-2.

#### 2-5-3. Water Supply Programme in the Niger State

The objectives of the water supply sector in the State proposed by the Fourth National Development Plan are as follows:

- \* To increase and improve the present capacity of water supply to the various settlements, the financial resources of which will be made available to the State Water Board by the government.
- \* To take the bulk of the allocation to the subsector for the additional treatment plants, tanks, reticulation system extensions, dam construction, etc.

- \* To plan a massive semi-urban water supply scheme covering all the districts in the State with external financing.
- \* To ensure safe and potable water all-year round in all villages of the State.
- \* To embark on rural water supply scheme programme by the Water Board in close cooperation with the State Ministry of Rural Development and Cooperatives, and various local government councils.
- \* To procure relevant equipment, machinery, materials and provide labour, even if funds allotted to the Water Board by the government is limited.

The budget of the water supply sector for the last five years is shown in Table 2-12. While most of the budget for urban water supply has been allocated to the Water Board in 1987, a budget has been allocated to WATSAN Project for the rural water supply with 2 million Naira in 1989. Two major water supply projects; namely Bi-water and WATSAN Projects, are given 2 million Naira and 20 million Naira, respectively, out of 77.5 million Naira of capital expenditures in 1989.

Proposed water supply projects in the State is as follows:

- \* Bi-water Project (about 63.74 million Naira): Project will cover 149 communities with total population of 1.2 million people. Major project areas are as follows:
  - Kontagora water works ..... 40,000 people/1988
  - Chanchaga water works ..... 150,000 people/1988
  - Bids water scheme ..... 90,000 people/1988
  - Wushishi water scheme ..... 35,000 people/1988
- \* DFERRI
  - Borehole drilling scheme:
    - Planted --- 210 boreholes
    - Completed-- 42 boreholes
- \* WATSAN Project
  - Borehole drilling scheme
    - Planted --- 125 boreholes
    - Completed-- 145 boreholes
- \* Urban Water Supply Project (2.7 million Naira)
  - Construction of water tank in Minna

Two of above projects, DFERRI and WATSAN Projects, has been realized in the rural areas, however, only 0.5 million Naira has been disbursed from January to June, 1988 for Bi-water Project due to insufficient personnel arrangement for the implementation.

Table 2-12

## BUDGET FOR THE MINISTRY OF HEALTH, NIGER STATE

	1985	1986	1987	1988	1989
<b>RECURRENT EXPENDITURE</b>					
Personal Emoluments	2,969,260	3,478,466	3,225,633	3,100,980	3,820,930
Allowances	728,480	204,195	1,289,002	954,878	625,249
Over Head Cost	84,750	569,905	862,000	845,000	942,000
<b>TOTAL</b>	<b>3,782,490</b>	<b>4,252,566</b>	<b>5,376,635</b>	<b>4,900,858</b>	<b>5,388,179</b>
<b>CAPITAL EXPENDITURES</b>					
Rural Hospitals	4,000,000	300,000	700,000	3,000,000	1,600,000
Primary Health Care Service Program/Basic Health Care	-	100,000	350,000	1,900,000	1,975,000
Improvement of Existing Hospitals and rural Health Center	500,000	700,000	1,445,000	500,000	1,000,000
School of Midwifery Hospital	-	-	-	250,000	300,000
Completion of School of Health Technology	-	250,000	100,000	200,000	188,000
Hospital Maintenance Workshop	-	-	-	-	300,000
Other	200,000	250,000	-	1,100,000	500,000
UNICEF RUWATSAN	-	-	1,000,000	1,000,000	2,000,000
<b>TOTAL</b>	<b>4,700,000</b>	<b>1,600,000</b>	<b>3,595,000</b>	<b>7,950,000</b>	<b>7,863,000</b>

(Government of Niger State of Nigeria 1985 - 1989 Estimates)

## BUDGET FOR WATER SUPPLY AND RESOURCES, NIGER STATE

	1985	1986	1987	1988	1989
<b>RECURRENT EXPENDITURE</b>					
<b>WATER BOARD</b>					
Over Head Cost	1,297,000	1,900,000	1,700,000	2,450,000	3,512,400
<b>CAPITAL EXPENDITURE</b>					
<b>WATER BOARD</b>			1,000,000		20,000,000
Bewater Project				63,743,119	53,010,000
Urban Water Supply	2,500,000	600,000		2,700,000	368,000
Semi Urban Water Supply		100,000			
Drilling of Borehole	550,000	100,000			
Equipment and Machinery	500,000	400,000			
Maintenance of Water Supply Infrastructures		50,000			
Purchase of Chemicals					2,000,000
<b>MINISTRY OF LOCAL GOVERNMENT</b>					
Rural Water Supply			1,000,000		
Dam Construction	300	50,000			
Sinkin of Local Well		30,000			
<b>MINISTRY OF HEALTH</b>					
UNICEF RUWATSAN			1,000,000	1,000,000	2,000,000
<b>TOTAL</b>	<b>3,550,300</b>	<b>1,330,000</b>	<b>4,000,000</b>	<b>67,443,119</b>	<b>79,448,000</b>
<b>GRAND TOTAL</b>	<b>4,847,300</b>	<b>3,230,000</b>	<b>5,700,000</b>	<b>69,893,119</b>	<b>82,960,400</b>

(Government of Niger State of Nigeria 1985 - 1989 Estimates)



Table 2-13. Number of Water Supply Facilities and Boreholes in the State  
(June, 1989)

LGA	Facilities	Borehole
CHANCHAGA(OLD)	13	36
GBAKO	10	22
MARIGA	15	29
SULEJA	4	11
AGAIE	1	3
LAPAI	15	28
LAVUN	17	46
MAGAMA	10	35
RAFI(OLD)	4	16
<b>TOTAL</b>	<b>89</b>	<b>226</b>

Table 2-14 Urban Water Supply Facilities under the Water Board

Name of Town	Population (×1,000)	Service Coverage (%)	Supplied Population (×1,000)	Output (cum/day)	Sources
Minna	211	60	120.6	26,000	River
* Bida	161	50	80.5	13,500	River
Suleja	23	30	6.9	2,300	River
K'Gora	44	80	35.2	9,000	River
Agaie	32	40	12.8	1,100	River
* Lapai	14	40	5.6	1,100	River
Mokwa	71	30	21.3	230	Goundwater
Kutigi	29	60	17.4	230	Goundwater
Doko	73	40	29.2	230	Goundwater
Lemu	117	40	46.8	110	Goundwater
Kacha	72	60	43.2	1,100	River
* Paiko	110	30	33.0	110	Goundwater
Rijau	32	30	9.6	110	Goundwater
Iteto	32	40	12.8	110	Goundwater
Zungeru	-	40	-	110	River
Kagara	22	50	11.0	110	Goundwater
* Kuta	146	70	102.2	2,300	River

Note : \* City/Town is located in the Project Area

#### 2-5-4. Water Supply Situation in the Project Area

##### (1) Water Supply Scheme by the State Water Board

The Water Board undertakes water supply schemes for urban and semi-urban areas under the Ministry of Works and Housing. Although construction of new water supply facilities by groundwater source is one of the tasks for the Water Board, no facilities were constructed since 1988 because of mechanical troubles of the drilling rigs.

The total number of water supply facilities and borehole sources are shown in Table 2-13. Most of these facilities are utilized for urban and semi-urban water supply purposes. Boreholes for rural water supply drilled by the Water Board is estimated to be about 200 boreholes.

The existing pipe water supply facilities in the Niger State managed by the Water Board is shown in Table 2-14. These facilities were constructed in the headquarters of LAGs/Districts, of which four of them are located in the Project Area.

##### (2) Rural Water Supply Plan

As mentioned above, the rural water supply project in the Niger State was undertaken by DRFFRI and WATSAN. WATSAN has drilled boreholes in Magama, Suleja and Chanchaga LGAs out of nine LGAs in the State. These boreholes in the rural areas are equipped with handpumps. Boreholes in each LGA drilled by WATSAN by June 1989 are accounted at 205 as shown in Table 2-15. The average drilling performance is calculated at 120 to 140 boreholes per year

Table 2-15. Number of Boreholes drilled by WATSAN

<u>LGA</u>	<u>No. of Borehole</u>
Magama	71
Suleja	80
Chanchaga	54
Total	<u>205</u>

DFRRI has drilled 42 boreholes for the rural water supply in the State on contract basis with private drilling companies, however, only about ten of them are functioning at present.

In summing up, the total number of boreholes for the rural water supply is about 415 in the State, including 205 by WATSAN, 10 by DFRRI and 20 by the Water Board. Beneficial rural population served by these boreholes is estimated at 187,000 on the assumption that one borehole can supply drinking water to 450 villagers. This shows that only 9% of the rural people can be benefitted by safe drinking water if distribution ratio between urban and rural is applied at 20 to 80 among the 2.5 million total population of the State.

### (3) Water Supply Situation in the Project Area

Water supply situation in three objective LGAs is estimated almost same low level of provision of water supply facilities. While in the headquarters of LGA and District have been provided with pipe water supply systems by the Water Board, the rural areas have not been provided with such systems, although they have utilized surface water, pond and hand dug well, almost of which are inadequate for drinking water in terms of quantity and quality. Name of towns provided pipe water supply systems are Kuta, Lapai and Bids in headquarter of LGAs, Gwada and Erena in Shiroro LGA, Gutu and Muye in Lapai LGA, and Kataeregi and Badeggi in Gbako LGA.

The Study Team conducted actively a survey the water supply situation in regard to Guinea-worm disease in 20 villages in the Project area. As shown in Table 2-16, 19 boreholes were found in 13 villages out of 20 villages. However, only 7 boreholes are functioning out of 19 boreholes because of mechanical troubles of pumps and deepening of water level. The figures seem optimistic because the villages visited by the Team were benefitted more sufficient infrastructure compared with rest of another villages.

As shown in Table 2-16, the number of borehole is accounted to 10% of the total sources. Although there is a problem on water quality pollution, Guinea-worm free dug wells account to 36 wells or 51% of total sources, however, 32 of them were dried up in the dry season. Consequently, villagers have to utilize water sources from pond and or stagnant surface water for more than 6 months with a risk of Guinea-worm disease.

Table 2-16. Water Sources in the Surveyed Villages  
(20 Villages)

Sources	No of Source	
	Nos.	%
Borehole	7	10
Hand dug well	36	51
Pond	15	21
Surface Water	12	18
<b>TOTAL</b>	<b>70</b>	<b>100</b>

Table 2-17. Water Sources in the Villages effected by Guinea-worm Diseases  
(13 villages)

Sources	No of Source	
	Nos.	%
Borehole	2	4
Hand dug well	31	16
Pond	8	16
Surface Water	8	16
<b>TOTAL</b>	<b>49</b>	<b>100</b>

(JICA Study Team, 1989)

As shown above, Table 2-17 summarizes kind of water sources in Guinea-worm effected villages. Twenty-five dug wells out of 31 wells were dried up during dry season, therefore, only 8 sources (2 boreholes and 6 dug wells) can only provide safe water to the villagers.

## 2-5-5. Administrative Organization of Water Supply Works

The major organization of water supply works in the Niger State are DFRRI, the Water Board under the Ministry of Works and Housing, and WATSAN Project Office under the Ministry of Health.

### (1) DFRRI

DFRRI is financed by the Federal Government to provide roads, roads and rural infrastructures in the remote areas. Provision of boreholes for the rural water supply is one of major tasks of DFRRI. In 1988, 42 boreholes were drilled by contractors in the State, however, most of them are not functioning during dry season.

### (2) The State Water Board

The Water Board was established in 1976 and provided water supply facilities in the urban and semi-urban areas. The Board has the following responsibilities:

- a) To establish, control, manage and develop new water works and to control, manage and develop the existing water supply facilities for the purpose of providing water for the industrial and domestic needs of the people of the State.
- b) To conduct such researches as are necessary for the fulfillment of water management.
- c) To ensure that adequate and potable water is supplied to the consumers at reasonable charges.

The Board consists of five Departments; namely, Administration, Project Planning, Operation and Maintenance, Water Quality Control and Construction with 1,140 personnel as at present. The organization chart of the Board is shown in Figure 2-4.

### (3) WATSAN Project Office

The UNICEF-assisted WATSAN Project in the Niger State was inaugurated in 1987 following the other WATSAN Projects in Imo, Gongola, Cross River, Kwara and Anambra States.

The terms of reference of the Project include the following:

- a) To build institutional capacities in providing potable water to rural areas, through a minimum handpump-equipped borehole and application of other

low cost technologies such as spring development and rainwater catchment;

- b) To develop and sustain "Village Level Operation and Maintenance (VLOM)" of the water points through training of one village based worker per water point, and promoting the privatization of water point maintenance at village level.
- c) To propagate Ventilated Improved Pit (VIP) latrine construction technology at village level and simultaneously provide on-the-job training of artisans.
- d) To improve environmental sanitation and excreta disposal through community mobilization, health education and communication techniques. The effectiveness of this component will be indirectly measured by reduction of faecal coliform counts in household water source.
- e) To eradicate water-borne diseases, such as Guinea-worm which can be achieved by improving the water supply and health education in affected areas.
- f) To develop a data-base for the systematic development of water resources in the future.

Boreholes drilled by WATSAN Project account for 205 holes in total including 80 in Suleja, 54 in Chanchaga and 71 in Magama LGAs, respectively, as of June 1989.

The Project Office is located near the Ministry of Health which includes administration office, health education room, laboratory, store room and workshop with a total area of 8 ha.

The Project has a programme to construct 100 boreholes with 2 drilling rigs per year.

Figure 2-5 shows the organization chart of WATSAN Project Office

Fig. 2-4 ORGANIZATION CHART OF WATER BOARD

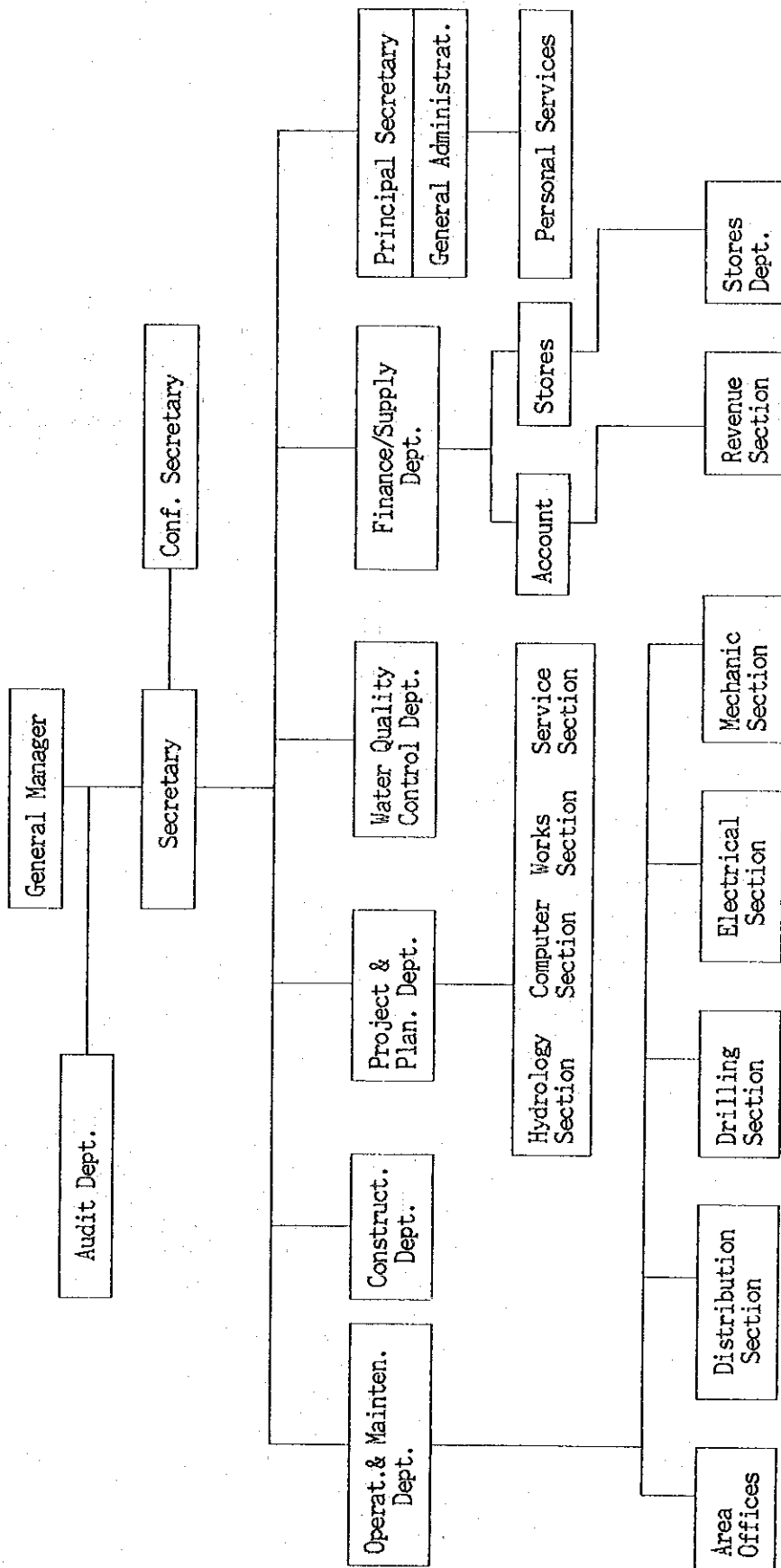
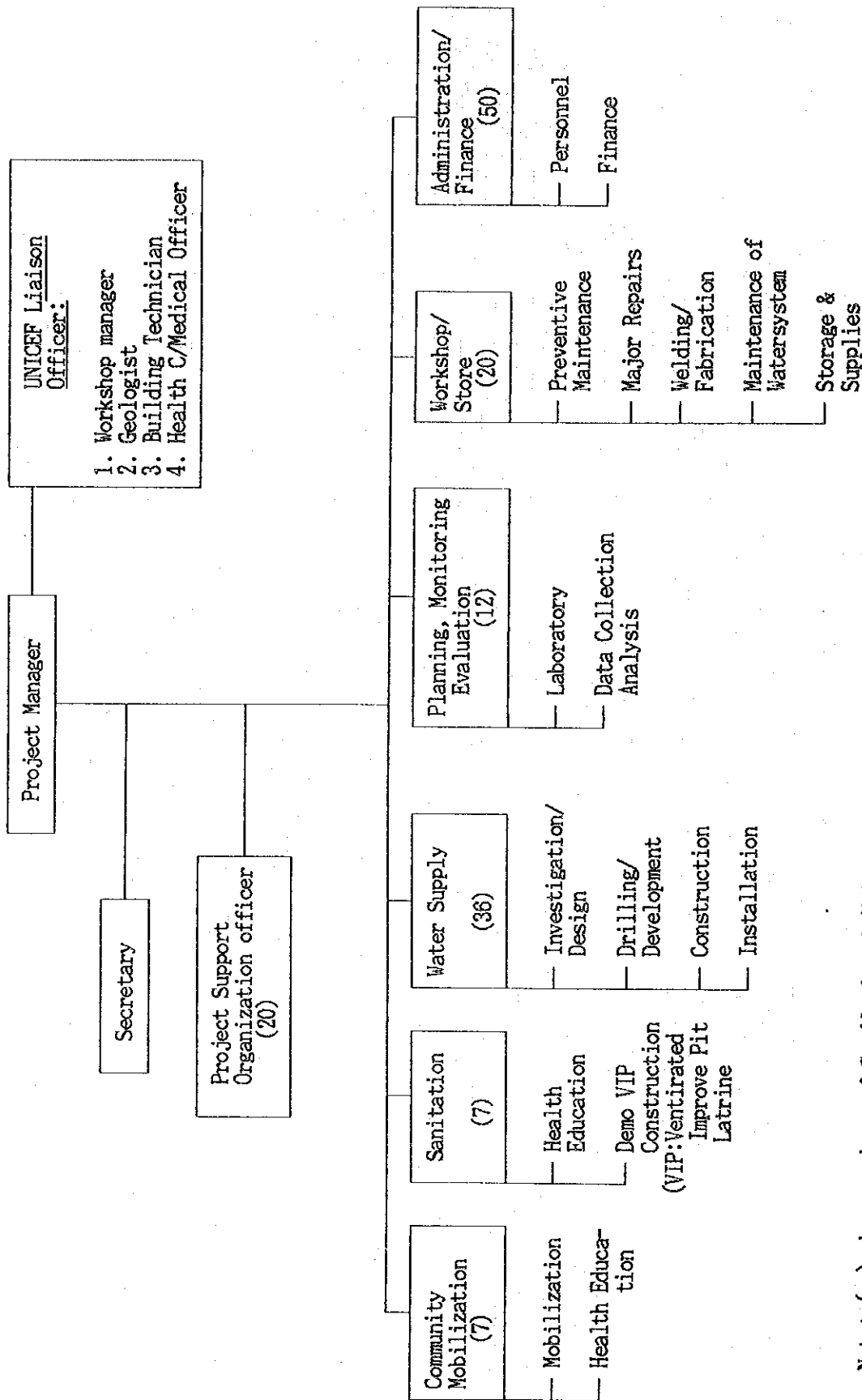


Fig. 2-5. ORGANIZATION CHART OF RUMATSAN PROJECT OFFICE IN NIGER STATE



Note: ( ) shows numbers of Staff of each Unit.



## CHAPTER 3. GENERAL DESCRIPTION OF PROJECT AREA

### 3-1. Natural Environment

#### 3-1-1. Location and Topography

The topography of the country can be characterized into two specific features:

Three highland areas formed by the River Niger originating in the Guinea highland and the River Benue running out of Cameroon, and the flat lowland areas developed along the above two rivers and the coastal areas along the Guinea Bay. Namely, the three high mountain areas from the northern central, the eastern/northeastern highlands, and the western plateau. The flat lowlands are composed of Sokoto Plain, areas located along the big rivers, Chad Basin, and delta prevailed along the Bay.

The vegetation of the country can be classified as tropical rain-forest in the coastal area, the Savanna in the central area and the grassland in the north. The Project area, Niger State, is located in the Savanna area of the country.

The State is located in the range from 4°30' to 7°30' east longitude and from 8°30' to 11°30' north latitude. The State has an area of about 58,530 sq.km, and the Project area covers about 17,050 sq.km, occupying 29% of the whole State. The State is located in the central part of the country, which is bounded by the Sokoto State in the north, the Kaduna State and Abuja Federal Capital Territory in the east, and the Kuwara State in the south-west divided by the Niger River.

Minna city, the state capital, is located 650 km from Lagos. It takes about seven hours by road and one hour by air from Lagos. The Project area is composed of Shiroro, Gbako, Lapai LGAs, which are located about 50 km northeast, 80 km southwest and 60 km south of Minna, respectively.

The elevation of the State ranges from less than 100 m to more than 600 m, along the mountain areas in the northeastern part. The topography of the Project area consists of low and swampy lands composed of the Niger Basin in the southern part, the granites hills in northeastern part and the mountain area in the northern part.

The topography of the Project area can be summarized as follows:

<u>LGA</u>	<u>Topography</u>	<u>Altitude (m, ansl)</u>
Shiroro	Mountain area in northeastern part and the granites hills	about 300 - 600 150 - 300
Gbako	Granites hills and lowland of Niger Basin	about 150 - 300 60 - 150
Lapai	Lowland of Niger Basin and flood plain of Niger river	about 60 - 150 45 - 60

### 3-1-2. Population

The State has an estimated population of about 2.5 million in 1988 and the population density is about 43 persons/sq.km. These figures, however, could not be obtained from statistical data as there is no demographic census since 1963. The rate of increase of the population is estimated at three percent per annum. (Source: National Population Bureau).

The population change of the State for 1982-1986 is shown in Figure 3-1.

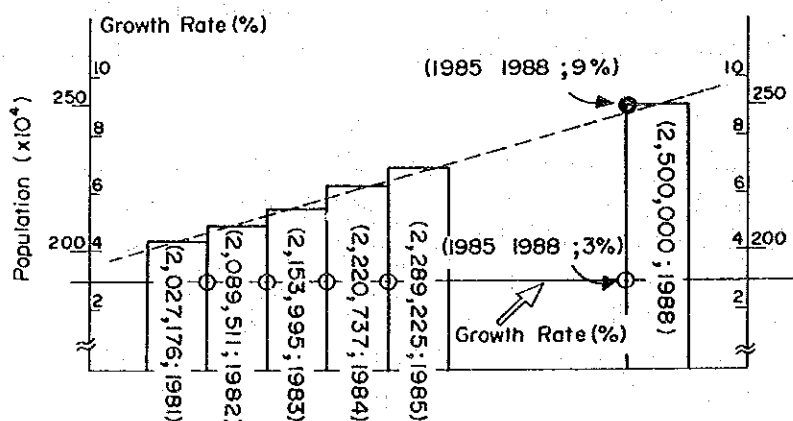


Fig. 3-1 GROWTH RATE OF POPULATION IN THE STATE  
(Source : NATIONAL POPULATION BUREAN)

The State is administratively divided into nine local government areas (LGA). The projected population by each LGA is shown in Appendix 8.

The Government of Niger State has newly modified some LGA areas and its names in June 1989 including Shiroro LGA. The population and its density are shown in Table 3-1, based on the new LGA.

Table 3-1. Population of the Project Area

<u>LGA</u>	<u>Population (no.)</u>	<u>Area (Km<sup>2</sup>)</u>	<u>Density (No./Km<sup>2</sup>)</u>
Shiroro	225,327	9,633	23
Gubako	449,451	4,528	99
Lapai	99,188	2,886	34
Total / Average	773,964	17,047	45

The population of the Project area is about 774,000 with density of 45 persons per sq.km. and the project area covers about 17,000 sq.km. of the State. Shiroro LGA has the biggest population, while Lapai LGA has the smallest one. The population density of Gbako LGA is one of the biggest in the State.

About 88% (2.2 million) of the population in the State are living in the rural area and engaged on agriculture. Almost all people (over 90%) have no safe drinking water, as described in Chapter 2.

### 3-1-3. Geology

Geological units and map of the Project area are shown in Table 3-2 and Figure 3-2, respectively. Geology of the Project area is classified into two large groups: (1) Basement rocks, and (2) Sedimentary rocks, which are described below.

#### Basement Rocks Area

The basement rocks predominate in Shiroro LGA, the northeastern part of Gbako LGA and northern parts of Lapai LGA.

The basement rocks consist of Pre-cambrian and Cambrian crystalline rocks, and they are usually divided into three local lithological systems; namely, the granitic rocks, schist belts and migmatite complex.

The granitic rocks intrude into the schist belts and the migmatite complex. The younger granites of granitic rocks which are known to be the youngest of the basement rocks are found in a scattered pattern in the other crystalline rocks. The large body of granitic rocks consist of mainly tonalite and granodiorite are distributed in the northeast to southwestern parts of Minna city.

The schist belts are distributed in Shiroro LGA with narrow N-S trend. They are divided into Kushaka schist belt, Birnin Gwari schist belt and Ushama schist belt from east to west. The schist belts are mainly composed of schist, phylites and amphibolite. The Zungeru mylonites distributed along the schist belts.

The migmatite complex covers 60% of the basement rocks area and generally formed parallel structure with the schist belts. It is composed of migmatites, gneisses and granites, especially Pre-pan-African Migmatite is oldest rock in the area which is distributed in the northern part of half of Lapai LGA.

The basement rocks area can be divided into two hydrogeological groups. They are granitic-magmatites group and schist-mylonites group.

Table 3-2. Geological Units for Project Area

Time	Geology	Litho-units
Cenozoic ~	Sediment (Alluvium)	Clay-Silt-Sand
Mesozoic ~	The Middle Niger Basin Sedimentary rocks (Cretaceous)	Nupe sandstone-Claystone-Shale ————— Bida Group
Palaeozoic ~	The Basement Complex (Pre-Cambrian to Cambrian)	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-right: 10px;">                     Pan-AFRICAN Granitic rock (Porphyritic granite-Granodiorite) Tonalites (Tonalite-Granite-Granodiorite)                 </div> <div style="margin-left: 20px;">                     —————                      Granitic rocks (500~750Ma) *                 </div> </div>
Pre-Cambrian		<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-right: 10px;">                     Pan-AFRICAN Migmatites (Migmatite-Tonalite-Granodiorite) Ushama Schist belt (Mica schist-Quartz schist-Amphibolite) Birnin Gwari Schist belt (Phyllite-Metagreywacke-Pebbly schist) Kushaka Schist belt (Phyllite-Mica schist-Amphibolite)                 </div> <div style="margin-left: 20px;">                     —————                      The Schist Belts (600~1100Ma) *                 </div> </div> <p>Zungeru Mylonites (Mylonite-Phyllite-Schist-Amphibolite) Pre-Pan-AFRICAN Migmatites (Migmatite-Gneisses)</p>

Ma: Mega-annum (×106year)

\* : Dr. A. C. Ajibade (Federal University of Technology, Minna, Nigeria), et al.

### Sedimentary Rocks Area

The sedimentary rocks are distributed in Gbako LGA except the northeastern and southern parts of Lapai LGA. The sedimentary rocks include quarternary deposits prevailing in the Middle Niger Basin and Cretaceous rocks.

Quarternary deposits are composed of clay, silt and sand of alluvium, predominating along the big river such as River Niger, River Kaduna and River Gbako.



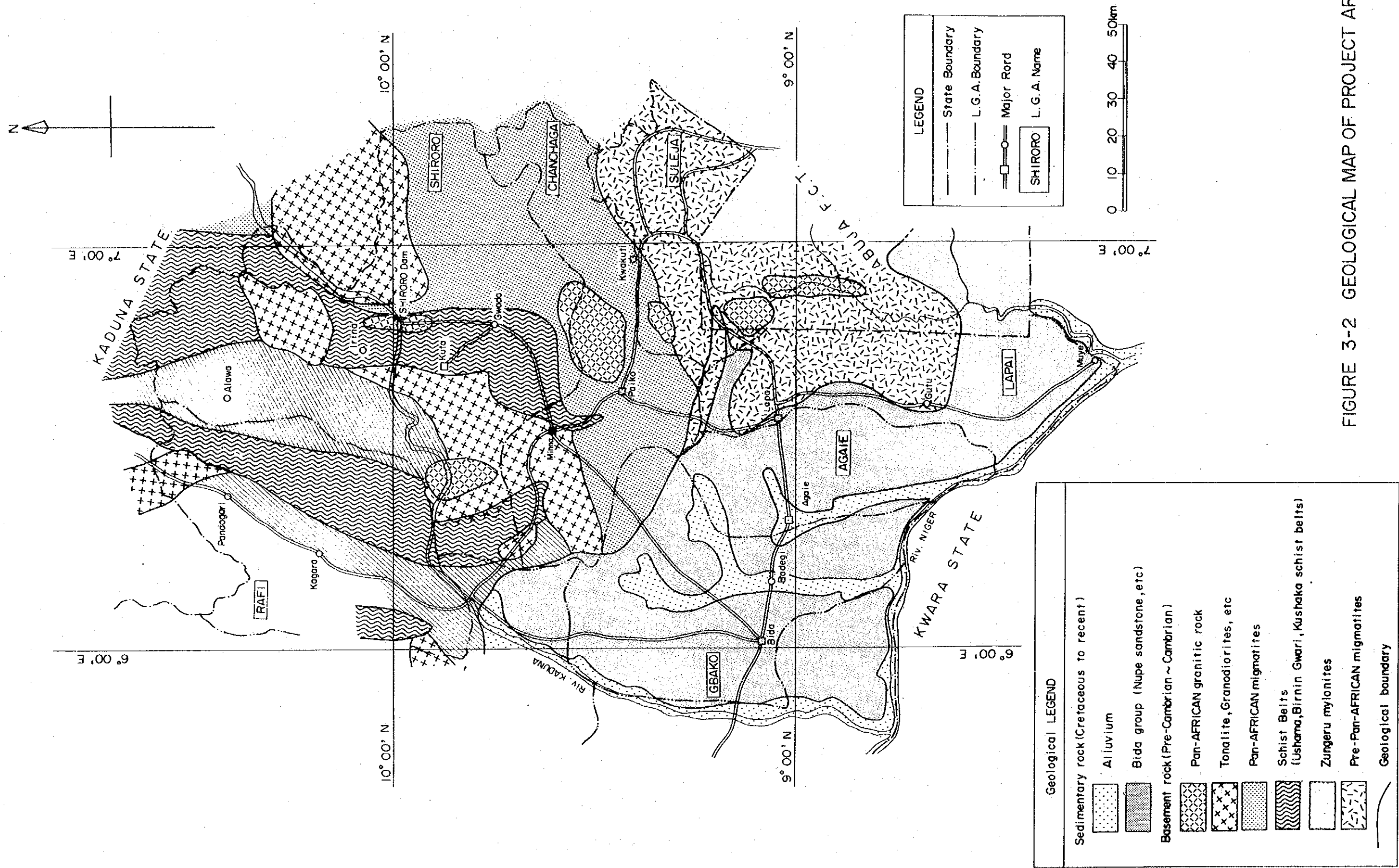


FIGURE 3-2 GEOLOGICAL MAP OF PROJECT AREA



Cretaceous sedimentary rocks consist of sandstone, mudstone and shale which are distinguished in Bida group, and confirmed by the survey result as: (1) Upper-sandstone, (2) Upper-mudstone, (3) Lower-sandstone, and (4) Lower-mudstone layer in the area. They are generally lying with flat structure and predominated with interfinger structure in the area.

The Upper-sandstone is considered as Nupe sandstone, a top layer of Bida group. The Upper-mudstone is mainly composed of mudstone and contains the same thin shale beds. The Lower-mudstone is considered as the lowest layer of Bida group in the Project Area.

The sedimentary rocks are forming steep cliff with height of about 50 m along floodplain of the middle Niger Basin in the southern end of Lapai LGA.

The sedimentary rocks area can be divided into two hydrogeological areas: (1) area composed of Alluvium along River Niger, and (2) area composed of sedimentary rocks..

#### 3-1-4. Meteorology

Nigeria can be classified into the following four climatic areas distributed in parallel to the equator as shown in Figure 3-3:

- a) Semi-equatorial climate - prevailing in the deltaic areas, 130 km - 160 km inland from the Ivory Coast with an annual rainfall of over 2,000 mm and a relative humidity of 60% to 80%.
- b) Climate in the hinterland of the tropical climate zone - prevailing in the area extending with about 240 km wide in the central part of the country with an annual rainfall in a range from 1,000 mm to 1,500 mm, and a relatively humidity of 50%-80% and four months of dry season.
- c) Tropical climate - prevailing in the northern part of the country with an annual rainfall in a range from 500 mm to 1,000 mm, a relative humidity of 20%-40% in January and 60%-70% in July, and a dry season lasting from April to August.
- d) Highland climate - prevailing in the highlands of Josu, Ayudawau and Ogbudo with an annual rainfall in a range from 1,000 mm to 1,400 mm.

The Project area belongs to the above classification b).



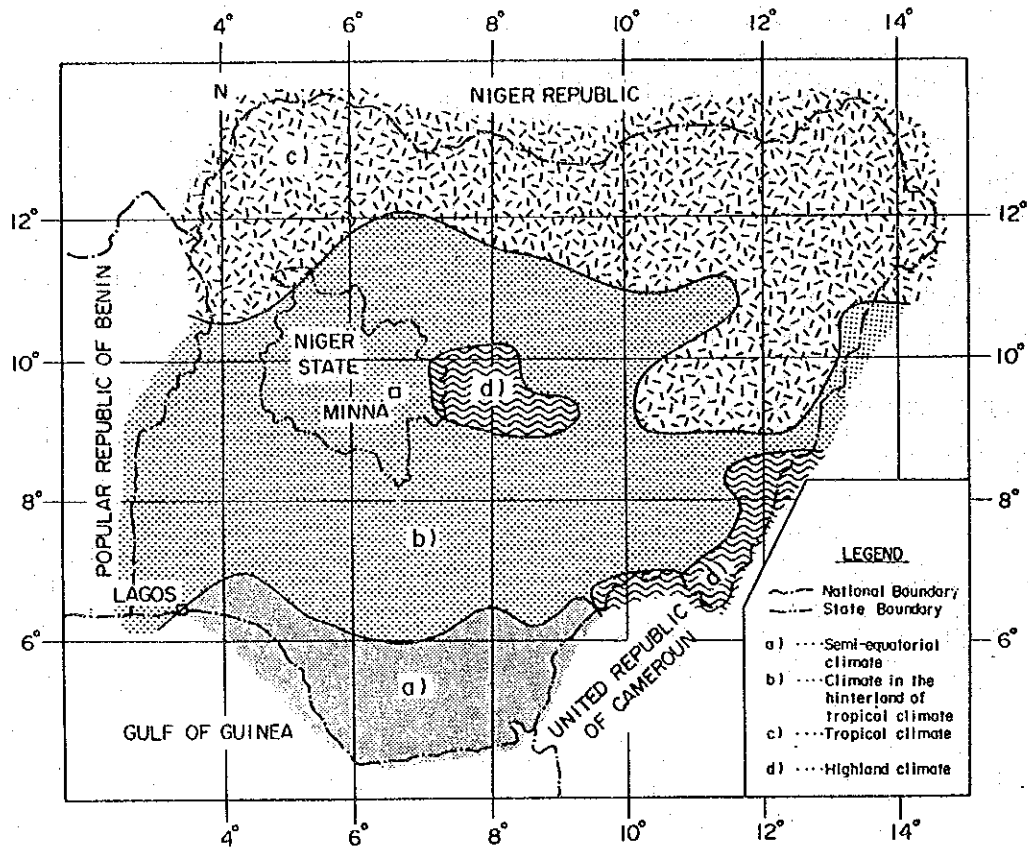


FIGURE 3-3 CLIMATIC AREAS

The rainfall data for five years (1982-1986) in Minna city are shown in Figure 3-4.

The above data shows that the maximum rainfall is 1,208 mm recorded in 1986, while the minimum is 794 mm in 1983. According to National Atlas, 1973, the mean annual rainfall is 1,046 mm and the dry season lasts for five months from November to March, while the wet season lasts for the remaining seven months from April to October with a mean monthly rainfall of 145 mm, and rainy days per month reaches about 15.3 days in average.

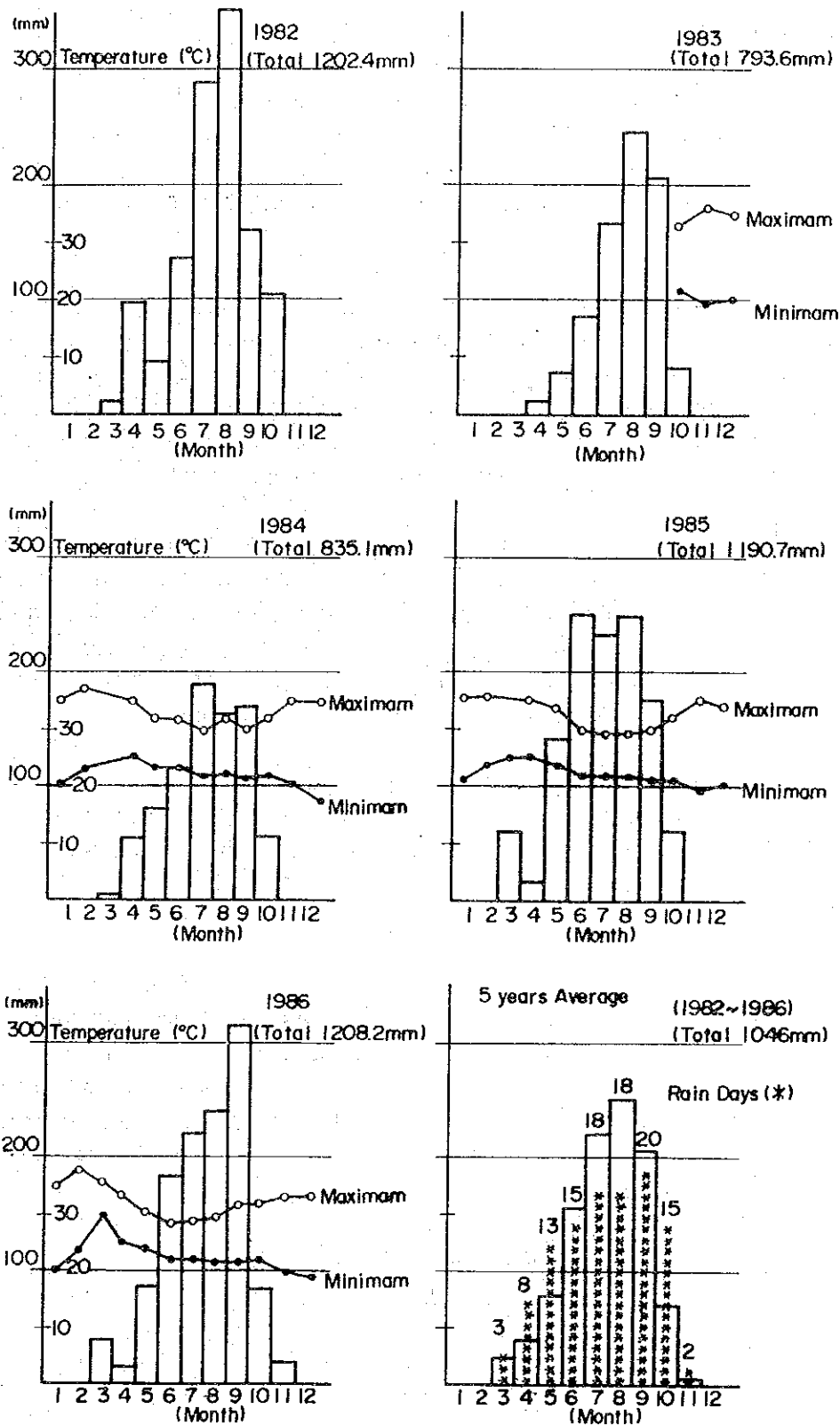


FIGURE 3-4 CLIMATE IN MINNA (1982~1986)  
 ( Source : DEPARTMENT OF METEOROLOGICAL SERVICES)