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Anambra State of Nigeria
Ministry of Health

World Bank/UNDP
Regional Water and Sanitation Group
Abidjan/Ivory Coast

Plans for Development of Rural Water Supply and Sanitation in Anambra State

Volume 1: Strategic Plan

IWACO
Consultants for Water & Environment

Head Office:
P.O. Box 183
3000 AD Rotterdam
The Netherlands

Rotterdam May 1989

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STRATEGIC PLAN

THE PRESENT REPORT CONSISTS OF TWO VOLUMES:

VOLUME 1: **STRATEGIC PLAN**

VOLUME 2: PLAN OF ACTION

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L I S T O F A N N E X E S

L I S T O F T A B L E S

L I S T O F F I G U R E S

LIST OF ABBREVIATIONS

ADB:	African Development Bank.
ADP:	Agricultural Development Project.
ANSWC:	Anambra State Water Corporation.
ASESA:	Anambra State Environment Sanitation Authority.
CDC:	Community Development Committee.
CDU:	Community Development Union.
DFRRI:	Directorate for Food, Roads, Rural Infrastructure.
DRD:	Department for Rural Development.
ES:	Environmental Sanitation Office (LGA).
JICA:	Japanese International Cooperation Agency.
LGA:	Local Government Area.
MOH:	Ministry of Works.
NBP:	National Borehole Programme.
RDA:	Rural Development Authority.
RPMCU:	Rural Water Supply and Sanitation Planning, Monitoring and Coordination Unit.
RUWATSAN	Rural Water Supply and Sanitation.
RWSG:	Regional Water and Sanitation Group, UNDP/World Bank Abidjan, Cote d'Ivoire.
RWS&S:	Rural Water Supply and Sanitation.
TU:	Town Union.
VBW:	Village Based Worker.
VWA:	Village Water Association.
WATSAN:	Water Supply and Sanitation, UNICEF assisted project.

1. EXECUTIVE SUMMARY

Recent developments

In 1987 the Regional Water and Sanitation Group of the World Bank / UNDP initiated among others two activities in the Federal Republic of Nigeria: the first resulted in the Sector Memorandum on Rural Water Supply and Sanitation in the Federal Republic of Nigeria and the second in a more specific Sector Memorandum for Anambra State. One of the recommendations of the second report was to establish a Plan of Action to draw interest of donors to fund short term improvements of the Rural Water Supply and Sanitation (RWS&S) sector in Anambra State. This activity has been executed by IWACO B.V., Consultants for Water and Environment, and has resulted in the present report.

The State Ministry of Health has represented the Anambra State Government during field activities of the IWACO mission. Almost all agencies involved in the sector have been visited by the Mission.

The Sector Memoranda recommend a sustainable development of RWS&S through community mobilization and involvement in operation and maintenance matters, and through health education.

General findings

High population densities are found in many parts of Anambra State (over 1,000 inhabitants/km^2). Built up areas are almost continuous in these parts. However most of them lack all facilities that one would expect in such 'urban' areas. For this reason they are generally classified as 'rural', but the type of technical solutions for improvement of water supply and sanitation would be 'urban' i.e. large distribution or sewerage networks.

This report is not aiming at such areas, but not because of denial of the needs for improvement of the situation. Activities in that respect are strongly recommended but do not fit in the scope of this work.

Physical conditions

The geological conditions vary considerably over the territory of Anambra State. A main feature is the escarpment that intersects the State in North-Southern direction just West of its Capital Enugu. The area East of this escarpment consists mainly of shales, while West of it sandstones are predominant. In the Western area good but deep aquifers can be found, in the Eastern area this is not the case.

Average rainfall varies from approximately 2,000 mm/a in the South of the State to 1,000 mm/a in the North.

EXECUTIVE SUMMARY

Organization of population

Anambra State consists of 23 Local Government Areas (LGA). Each of these is split up in a number of communities, on average 20 per LGA. A community consists generally of a number of villages.

The main ethnic group of Anambra State are the Igbo's. Traditionally they have a high sense of belonging to a village or community, but not any higher: LGA or State Authorities fit hardly in their traditional pattern. The willingness to engage in communal projects is high and all sorts of constructions are being developed at village or community level. This tradition seems to favour implementation of village based RWS&S projects.

Actual institutional framework

Actually a wide variety of State Agencies is involved in the RWS&S sector, but without much coordination. The Anambra State Water Corporation (ANSWC) has activities in the urban and the semi-urban areas where it operates mechanized systems only. ANSWC does not consider activities in hand operated schemes. Other Agencies like the State Department for Rural Development, the Rural Development Authority and the Federal Department of Water Resources are involved in construction projects of rural water supply facilities, but none of them has a leading role. The State Ministry of Health is involved in the sector through two projects in the sector with external financial assistance, both aiming at eradication of the Guinea Worm disease.

Existing RWS&S situation

In most villages visited RWS&S facilities are non existent. People serve themselves with surface water of low quality, especially at the end of the dry season. The few schemes that exist are generally in poor condition. Besides unachieved installations are frequently found. Rehabilitation of these existing installations must have priority over the construction of new works.

Sanitation facilities are only available to a very small proportion of the rural population. The majority chooses the bush for sanitation purposes. Improvement of this situation has low priority of the villagers.

EXECUTIVE SUMMARY

Target group

For identification of the group of rural people that needs improvement of their water supply and sanitation facilities the total projected population of the year 2000 is taken from which the urban people and people already served by existing or planned schemes are subtracted. This leaves an unserved rural population of 2.5 million in the whole State. According to Federal policy it is assumed that 60% of this group must be served in the scope of this strategic plan, which results in 1.5 million people. This estimate is only correct on the condition that planned RWS&S projects are indeed carried out, mainly by ANSWC.

Basic data

Reliable data for accurate planning purposes do generally not exist in Anambra State, nor topographical neither demographical information. Baseline surveys that combine interpretation of recent aerial photos and satellite images -resulting in topographic maps- with field surveys must improve this situation before the start of implementation activities.

Systems considered

For sustainability the type of systems considered must allow as much as possible operation and maintenance under direct responsibility of the beneficiaries. The technology must be adapted to this condition. Physical conditions however do not always allow low technology hand operated solutions, especially West of the escarpment. The following types of schemes are proposed:

SYSTEM	CONSTRUCTION* COSTS ($/CAP.)	RUNNING COSTS ($/CAP./YEAR)
Handdug wells	13	10
Borehole & hand pump	34	10
Spring captation	7	2.5
Impounded reservoirs	3	1
Deep boreholes with limited distribution	17	2.5

*) Does not include project costs; when project costs are included costs can be as much as 3 times higher.

EXECUTIVE SUMMARY

For sanitation the cheap Moçambique slab latrines are preferred over the two compartment VIP latrines. Construction costs of the underground part are estimated at 11 and 63$ for unlined and lined types respectively. These amounts are more in line with the villagers' low priority and willingness to pay for sanitation than those of the VIP latrines. Health education must generate the demand, but this will require much more time then for the water supply facilities.

Planning and funding requirements

The target group for the Strategic Plan has been identified for the year 2000, for reasons of availability of data. Given its volume a period of 10 years is short: a period of 15 years seems to be more appropriate from point of view of executing capacity. However population continues to grow, so taking the year 2005 as planning horizon increases the target group with another 13%, based upon the generally used annual growth rate of 2.5%. The following table gives an overview of the funding requirements for periods of 10 and 15 years:

Planning horizon (year)	2000	2005
Period (years)	10	15
Size of target group (* 10^6)	1.54	1.74
Costs involved (* 10^6 US$)	95	108
Annual funding requirements (* 10^6 US$)	9.5	7.2

Approach

The approach for implementation of the project must be in line with the objective to realise a sustainable improvement of RWS&S facilities. Community mobilization and health education are therefore key elements; the complete approach can contain the following elements:

- Baseline survey
- Support of State wide coordination activities
- Support of LGA's to implement RWS&S project in villages
- Technical and financial assistance in construction
- Monitoring and evaluation

Focal point of the activities must be the villages. Activities should be organized per LGA and planned, coordinated, supported and monitored by a unit that operates at State level. Activities at all the three levels need support with funds and expertise.

The construction can be done as much as possible by the private sector, existing or to be developed.

EXECUTIVE SUMMARY

Plan of Action

A Plan of Action is presented for short term RWS&S improvements in the three LGA's and for support of the State wide coordination and other activities.

It is estimated that 260,000 people can be served in four years for an amount of 16 million US$.

The Plan of Action is split up into activities per LGA and State. This allows funding of activities by one or several donors. It must be stressed that for achievement of long term goals it is essential that the State wide activities are started up at the same time and not after the activities in the LGA's.

2. INTRODUCTION

In 1987 a Sector Memorandum on Rural Water Supply and Sanitation (RWS&S) for the Federal Republic of Nigeria has been published on initiative of the Regional Water and Sanitation Group (RWSG) at Abidjan, Ivory Coast, of the World Bank/ UNDP Water Supply and Sanitation Group. In the same year a Memorandum on RWS&S in Anambra State of Nigeria has been prepared. In this last document it has been recommended to prepare a Plan of Action for short term activities in the sector in Anambra State. The RWSG invited IWACO B.V., Consultants for Water and Environment for this task. Figure 2.1 gives a map of the area of study.

The objectives for the study were to develop a Plan of Action for three Local Government Areas (LGA) that would fit in a long term strategic plan for the development of the RWS&S sector. The present report consists of two volumes. The first gives an overview of the rural water supply and sanitation sector in the whole State and includes a Strategic Plan for its development. A second volume concerns the three selected Local Government Areas for which activities are proposed in a short term Action Plan.

The three LGA's were selected prior to the visit of the IWACO team to Anambra State. During the initial visits of the Consultant's team it became clear that two of the three selected LGA were not representative to develop an appropriate methodology for RWS&S, as the population densities were too high. Therefore the mission requested the Anambra State Government in the person of the Commissioner for Health to revise the selection. As a result of the reconsiderations the following three LGA's were selected: Anambra in the West, Igbo-Eze in the North and Ikwo in the East of the State (see figure 2.2). These LGA's are reasonably representative for the whole of the State in terms of physical conditions and population densities.

The objectives of a Strategic Plan and a Plan of Action to improve the RWS&S situation in the State and more specifically in the three selected LGA's with emphasis on:

- sustainability
- replicability
- community involvement
- village level operation and maintenance
- institutional strengthening at LGA and State level,

which is in line with the 1986 Abidjan Statement and the recommendations of the Sector Memorandum for the Federal Republic of Nigeria (1987).

The IWACO mission visited Nigeria and Anambra State between January 25th and March 7th, 1989. The mission consisted of 5 persons from the following disciplines:
- sanitary engineer
- community involvement expert
- extension expert
- hydrogeologist
- institutional expert.

During this period the Mission had fruitful meetings with almost all agencies involved in RWS&S activities in Anambra State, and with the representatives of the RWSG in Abidjan. A preliminary summary of conclusions has been presented in Enugu and Abidjan at the end of the visit.

Acknowledgments

In this place we would like to express our special gratitude to Prof. A.B.C. Nwosu, Commissioner for Health and Dr. Anene Ben. Uzuakpunwa, Commissioner for Special Duties who have been the initiators of this study and who opened many doors to make it a success.

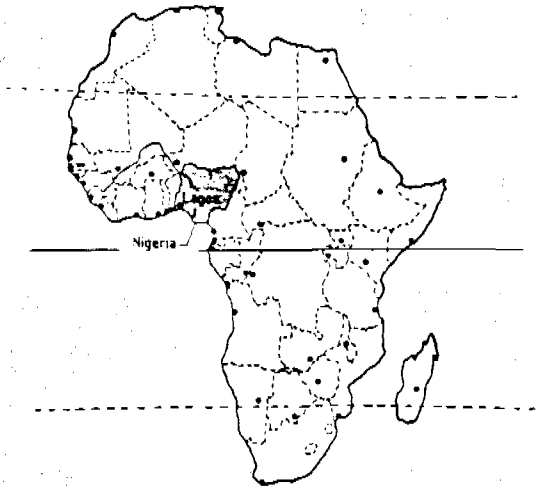
The mission is very gratefull for the fruitful discussions held with the representatives of many agencies among which:

the Departement for Rural Development
the Anambra State Water Corporation
the Rural Development Authority
the Agricultural Development Programme
the Federal Department of Water Resources
and the Chairmen, Councilors and staff of the three selected LGA's.

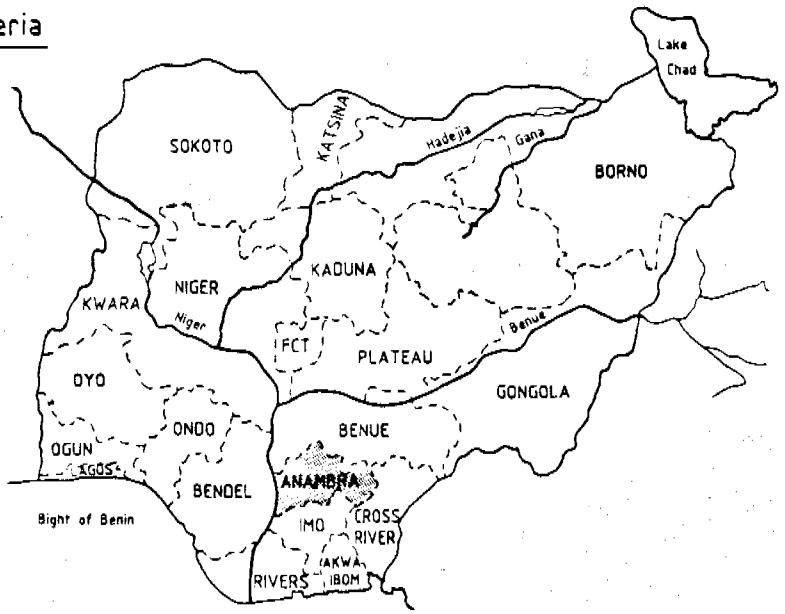
A welcome support has been obtained from the UNICEF Chief of Water and Sanitation Section, and other staff in Anambra and Imo State. Useful and encouraging remarks have been made by Engr. E.O. Okeke of the Federal Department for Water Resources.

The Mission sincerely thanks all who have spent their valuable time to pass the information necessary to elaborate this report.

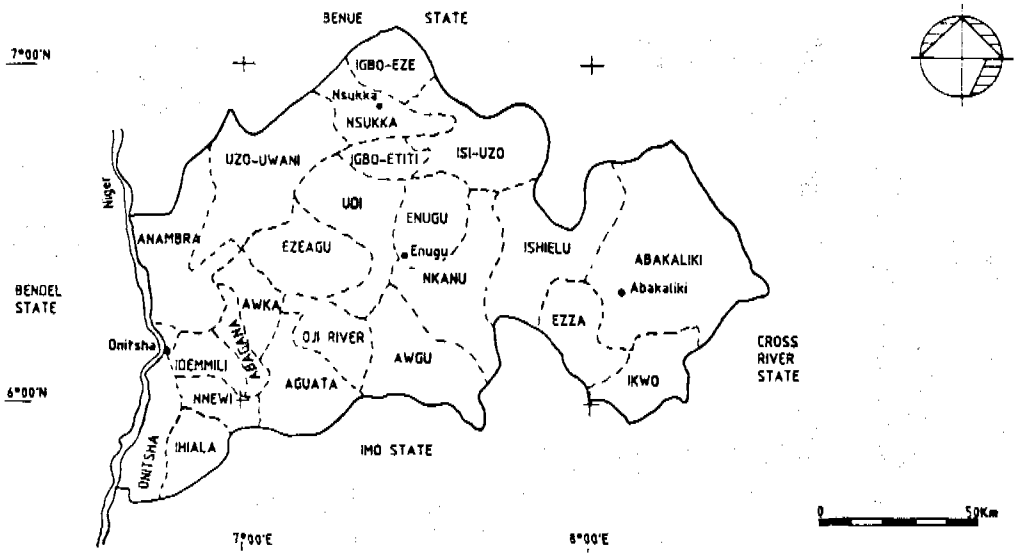
Africa



Federal Republic of Nigeria



Anambra State



Client
RWSG , UNDP / World Bank

Project
RWS & S Anambra State , Nigeria

Description
Location of area of study

Drawn
RVD

Figure number
2.1

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Date
04-'89

Drawing number
1805-2.1

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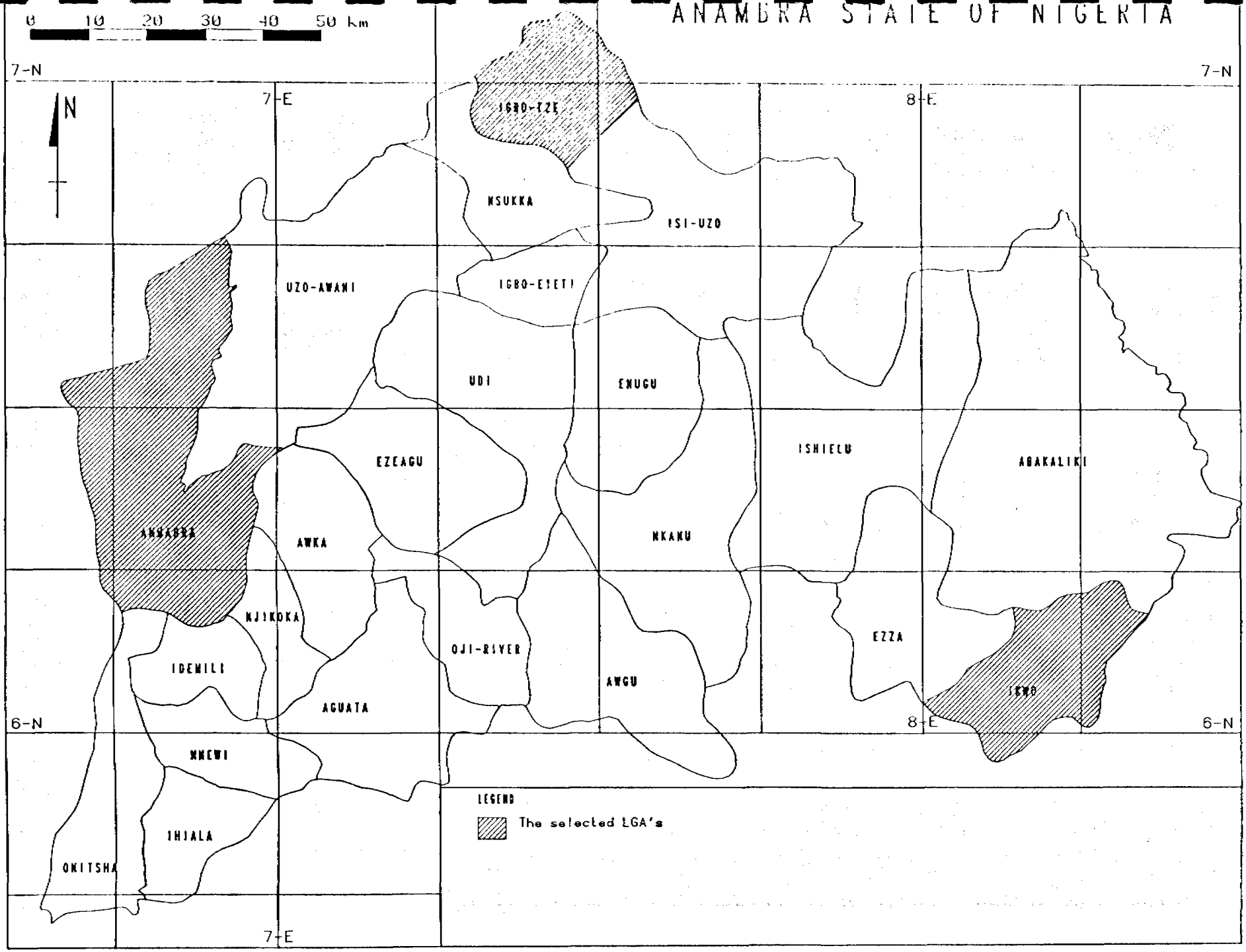

ANAMBRA STATE OF NIGERIA
0 10 20 30 40 50 km
N
7-N
7-E
8-E
6-N
IGBO-EZE
NSUKKA
ISI-UZO
UZO-AWANI
IGBO-ETITI
UDI
ENUGU
EZEAGU
ANAMBRA
AWKA
NKANU
ISHIELU
ABAKALIKI
NJIKOKA
IDEMILI
OJI-RIVER
AWGU
EZZA
IKWO
AGUATA
NNEWI
IHIALA
ONITSHA
LEGEND
The selected LGA's

Figure 2.2

3.1. SITUATION

Anambra State is situated in South-Eastern Nigeria between 6°30' and 8°30' East and 5°30' and 7°10' North (see figure 2.1). A topographical map is given on figure 3.1. Its capital Enugu is found in the center of the State. A journey from Enugu to Lagos takes 6 hours on good roads, most of them express highways. There are daily flights to and from Lagos. An express highway and a railway line link Enugu to Port Harcourt. Many tarred roads are constructed within the State so journeys are relatively easy.

Anambra has a total surface area of 17,300 km² and is divided into 23 Local Government Areas. The projected population for 1990 is 7.7 million inhabitants.

3.2. WATER RESOURCES

Anambra State has a climate that is characterized by a dry and a rainy season. The rainy season has its peaks in July and September with a short dry period in August. The dry season lasts from November till March. Average yearly rainfall varies from 2,000 mm in the South of the State to 1,000 mm in the North. Isohyets go almost straight from East to West. More detailed information on rainfall is given in annex 3.1 for 4 rainfall gauging stations.

Characteristic for the geological structure of Anambra State are a SW-NE anticlinal axe that goes over Abakaliki and a NS synclinal axe at the Western boundary of the State (see cross section on figure 3.2). On the anticlinal axes all the younger formations have been eroded off and the oldest Asu River Group (Cretaceous) is found at ground surface. Going from Abakaliki Westwards the formations at the surface become younger till the quaternary deposits of the Niger river. Most striking is the formation of the Lower Coal Measures that forms North-South directed escarpment that is very distinct throughout the State. Enugu was founded as a coal mine resort to exploit this formation so lays very close to the escarpment.

The older formations East of the escarpment are mainly shales, the younger formation West of the escarpment mainly sandstones. Figure 3.3 gives a lithologic map of the state. Relief is most distinct in most of the areas West of the escarpment.

The higher permeability of the sandstones plus the more distinct relief cause deep groundwater tables and rare surface water in the area West of the escarpment. Groundwater tables are much shallower in the area East of the escarpment, but due to high mineral contents (several zinc and lead mines are found in the Abakaliki area) groundwater is often of low quality.

A more detailed description of the geology is given in annex 3.2 that consist of a geologic map and a chrono-lithostratigraphic table, based on Gauff (1988) Geologic Survey (1962) and Uma and Egboka (1988). The latter distinguish five hydrogeological zones and do recommendations for rural water supply. The five zones are shown on figure 3.4 and have the following characteristics (after Uma and Egboka, 1988):

Zone 1: "The zone is underlain by middle cretaceous sandstones, fractured shales limestones and scattered pyro clastics and intrusives. Generally, the sandstone units are thin (less than 20 m) fairly well compacted and have low permeability, except at some localities where fracture porosity occurs. The near surface sandstones and fractured shales yield sufficient water to handdug wells and shallow boreholes with handpumps".

Zone 2: "is underlain by the Ajali Formation" ..... "The zone contains very prolific aquifers. The average yield of boreholes is over 50 m3/hr. Extensive well fields with motorized pumps can be developed. However the average depth to the groundwater is more than 60 m below the surface and schemes using shallow boreholes with handpumps or unproved handdug wells may not be successful".

Zone 3: "comprises areas underlain by the Nsukka and Ameki Formations and sandstone members of the Imo Formation. Promising confined aquifer systems occur at depths ranging from 60 m to 20 m below the surface. The yield of boreholes is variable with an average of about 30 m^3/hr." "Numerous springs occur and many of them are perennial".

Zone 4: "is underlain by the Imo Formation. The formation is made up of thick clay-shale units, sandy clays and minor clayey sand units. Borehole records indicate a high failure rate of boreholes completed in this zone. However at some localities high yielding artesian aquifers have been encountered at depths below 200 m of the surface", but they can be constructed in a very limited area only (see figure 3.5 that has been drawn after BRGM, 1979). "The only economic schemes are those using rainwater or stream sources".

Zone 5: "covers the extreme South-West and West of the State. It comprises areas underlain by the Ogwashi/Asaba and Benin Formation and the Quaternary alluvium of the River Niger Plains. Deep unconfined aquifers generally occur in this zone and the water table is everywhere less than 50 m below the surface. The average well yield is over 50 m3/hr but the hydraulic conductivity varies extensively, especially within the areas underlain by the alluvium".

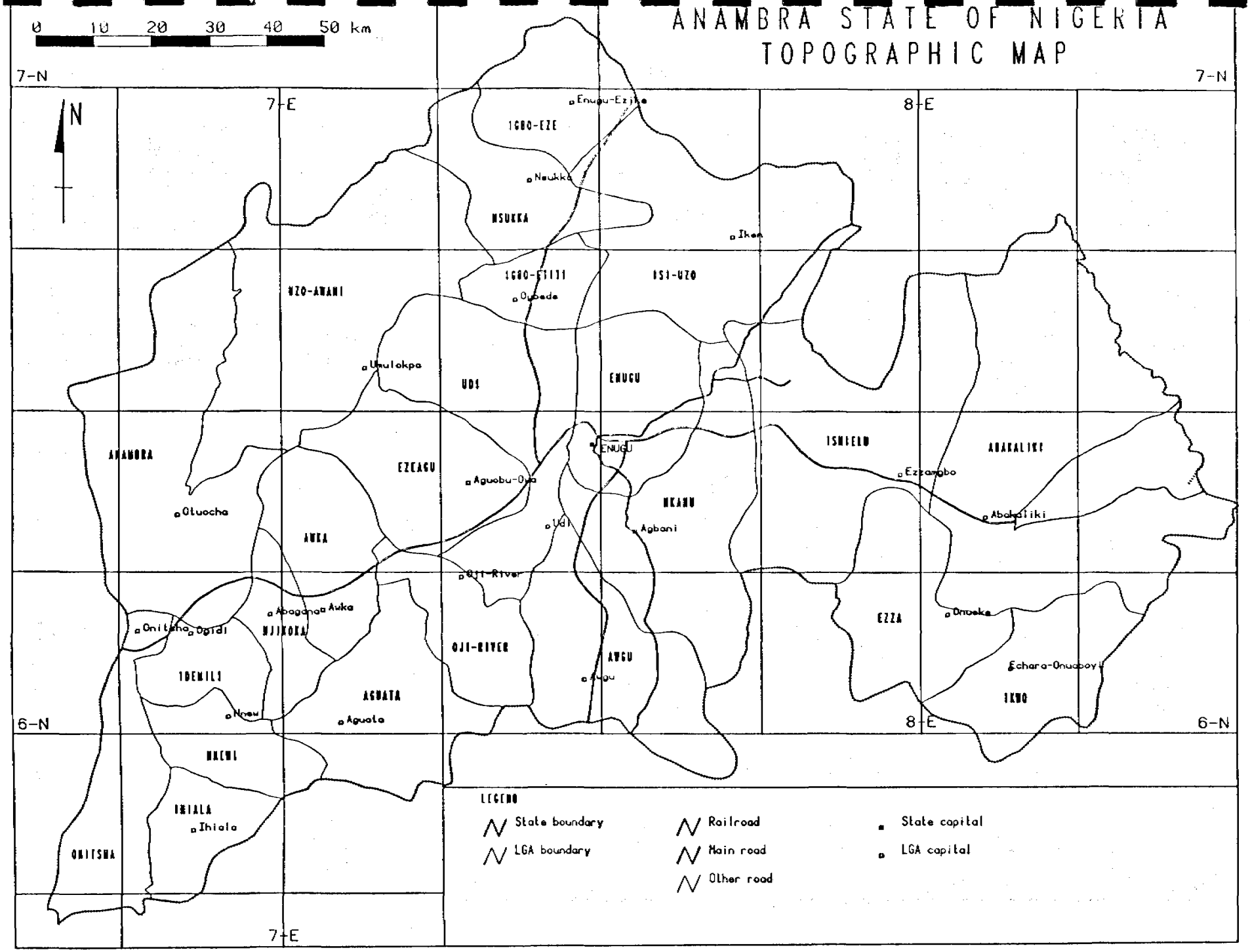
During field visits the findings of Uma and Egboka were confirmed. Most striking type of scheme that was additionally found was that of the impounded reservoirs for rainwater storage in the Eastern part of the State. This type of scheme is a source of Guinea worm infection but has great confidence of the local population for reasons of perenniality. Upgrading of this type of water supply in order to minimize the hazard of Guinea worm infection would be a useful first attempt in the area, in addition of ongoing UNICEF and JICA programmes.

Deforestation due to the human pressure on the natural environment is widely spread. The immediate effect is already visible: erosion is an immense problem, especially on the sandstones. A secondary effect will be the lowering of the groundwater table, related to a decreasing rainwater infiltration. This can lead to a serious affection of existing water resources: yields of wells and boreholes will be reduced and natural springs will dry up.

The two main rivers that drain Anambra State are the River Niger in the West and the Cross River in the South-East. The drainage pattern is determined by the geologic and geomorphologic features described before: the North-South escarpment forms the watershed (see figure 3.6). On the sandstones the streams are few, but most of them perennial, on the shales the drainage pattern is more dense, but streams tend to dry up by the end of the dry season.

Exploitation of surface water for drinking water purposes is widely spread but few installations are present. In most cases it concerns water collection by private persons or by water tankers. Among others the Greater Onitsha Water Scheme and the Abakaliki Water Scheme have surface water intakes.

The possibilities to create surface water reservoirs are good in the shale area. In sandstone areas losses due to exfiltration would be to high.


ANAMBRA STATE OF NIGERIA
TOPOGRAPHIC MAP
0 10 20 30 40 50 km
N
7-N
7-E
8-E
6-N
IGBO-EZE
NSUKKA
Nsukka
Enugu-Ezike
Iken
NZO-ANANI
IGBO-ETITI
Ozubede
ISI-UZO
Umulokpa
UDI
ENUGU
ANAMBRA
EZEAGU
Aguobu-Oyi
Otuocha
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Abakaliki
Oji-River
Abagana
Awka
Onitsha
Ogidi
NJIKOKA
OJI-RIVER
AWGU
Awgu
EZZA
Onueke
Echara-Onuabonyi
IDEMILI
Nnewi
AGUATA
Aguata
IKWO
NNEWI
IHIALA
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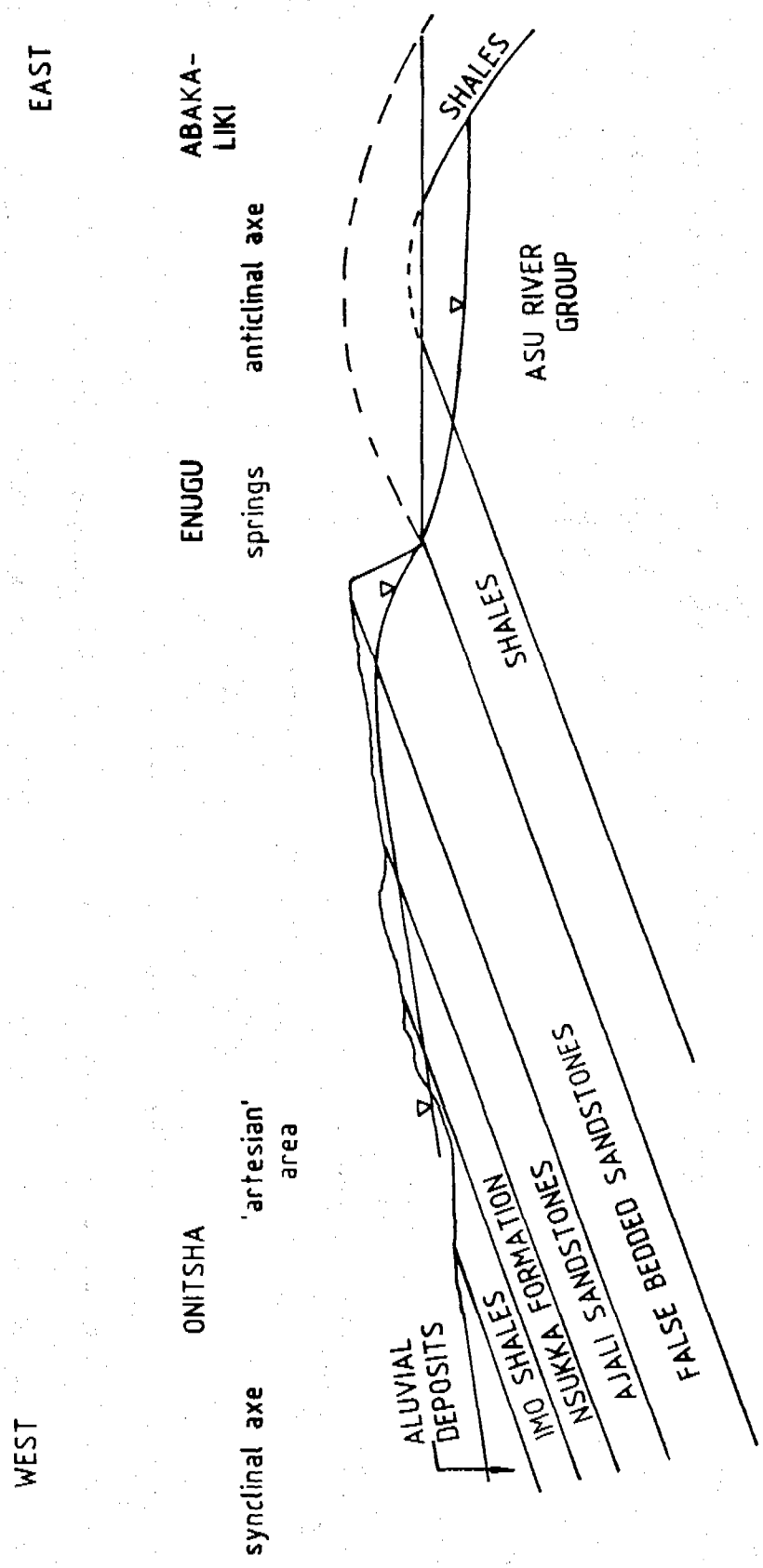
ONITSHA
LEGEND
State boundary
LGA boundary
Railroad
Main road
Other road
State capital
LGA capital

Figure 3.1



Client
RWSG , UNDP / World Bank

Project
RWS & S Anambra State , Nigeria

Description
Hydrogeological Cross Section

Drawn
HvD

Figure number
3.2

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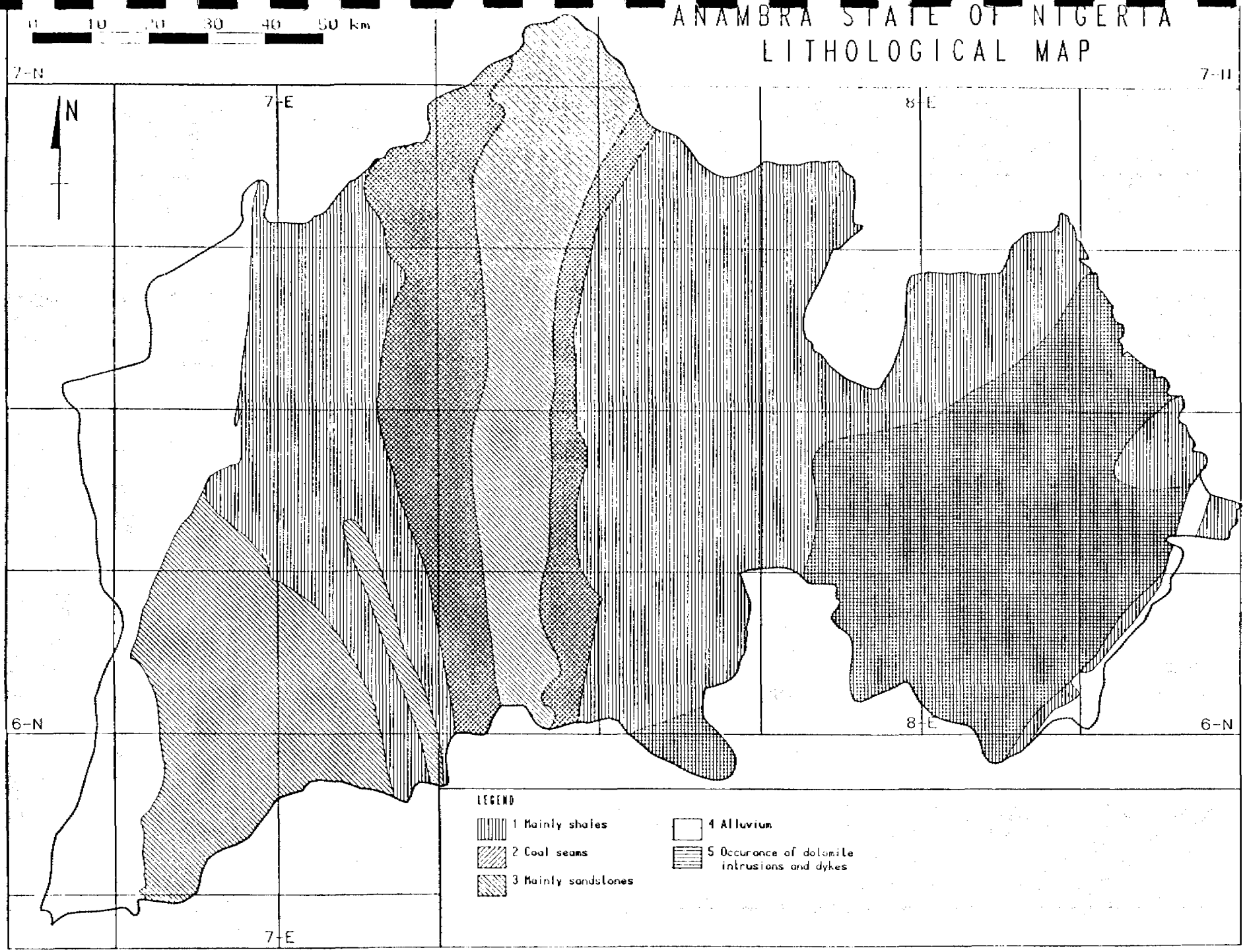
ANAMBRA STATE OF NIGERIA
LITHOLOGICAL MAP
0 10 20 30 40 50 km
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7-N
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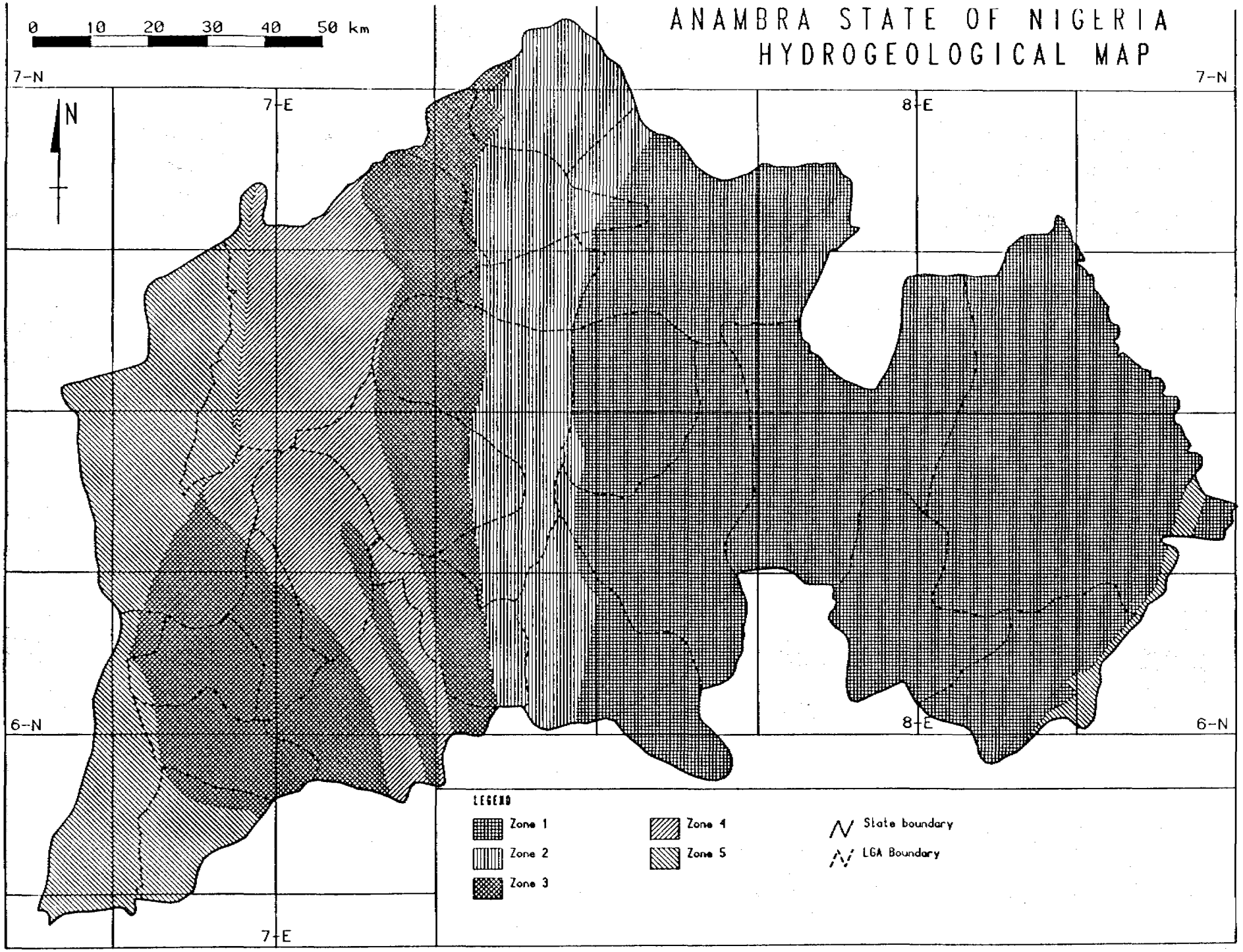
6-N
8-E
6-N
7-E
LEGEND
1 Mainly shales
2 Coal seams
3 Mainly sandstones
4 Alluvium
5 Occurance of dolomite intrusions and dykes

Figure 3.3


ANAMBRA STATE OF NIGERIA
HYDROGEOLOGICAL MAP
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8-E
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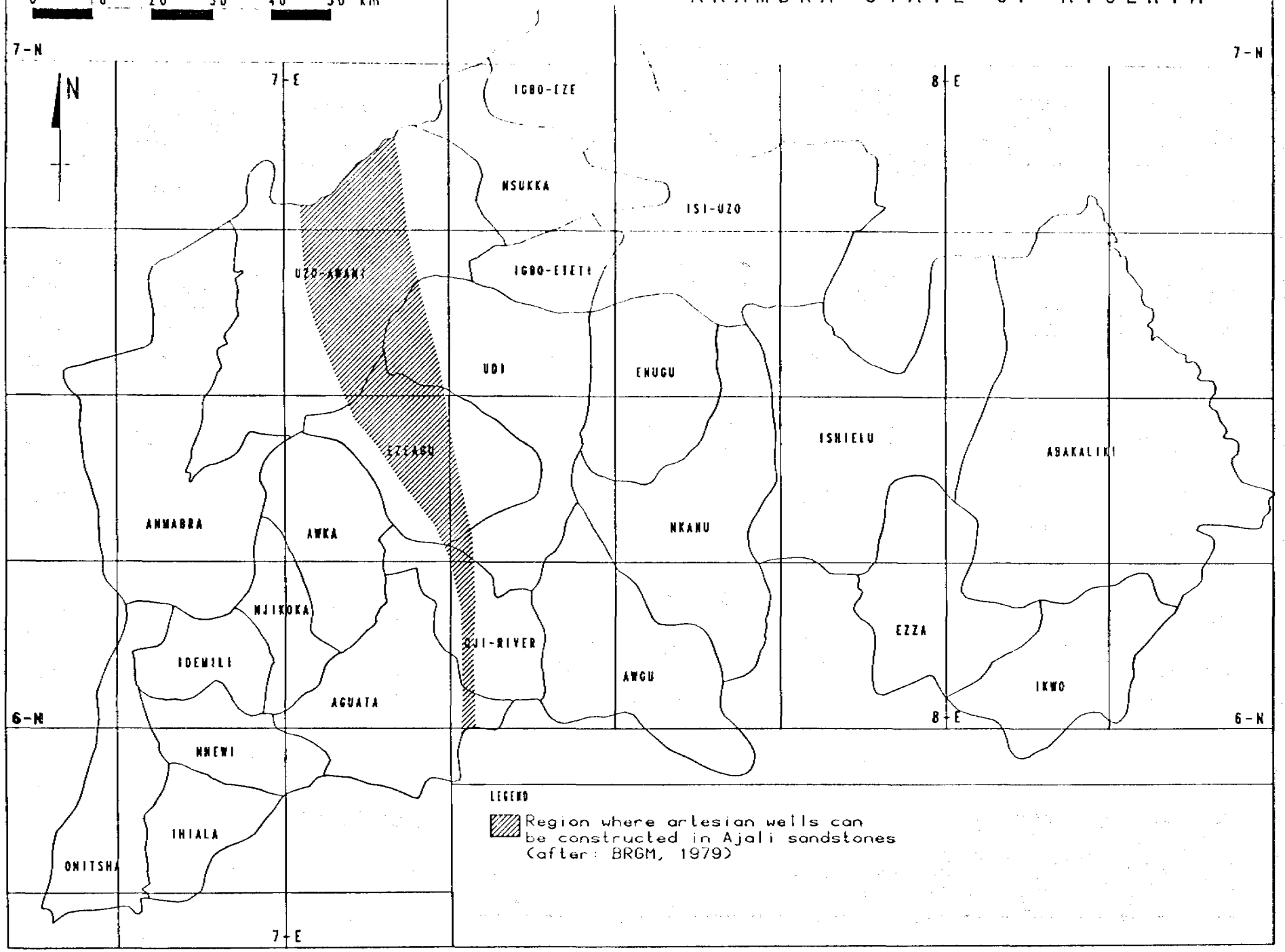
LEGEND
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
State boundary
LGA Boundary

Figure 3.4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OJI-RIVER
EZZA
IDEMILI
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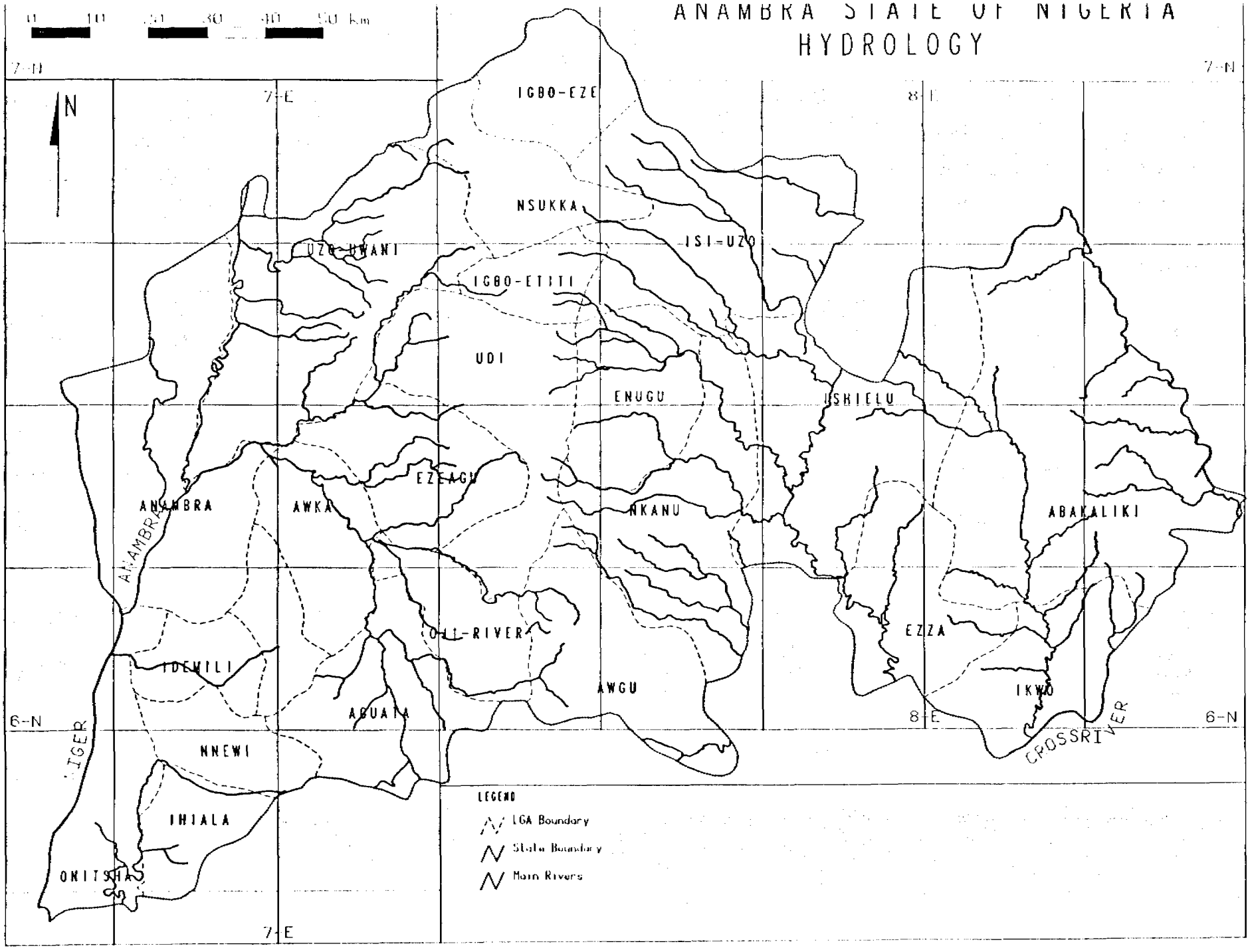
NNEWI
IHIALA
ONITSHA
LEGEND
Region where artesian wells can be constructed in Ajali sandstones (after: BRGM, 1979)

Figure 3.5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HYDROLOGY
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EZEAGU
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NKANU
ABAKALIKI
ANAMBRA
OJI-RIVER
EZZA
IDEMILI
AWGU
IKWO
AGUATA
NNEWI
IGER
CROSSRIVER
IHIALA
ONITSHA
LEGEND
LGA Boundary
State Boundary
Main Rivers

Figure 3.6

4. POPULATION AND SOCIAL ENVIRONMENT

4.1. DEMOGRAPHY

Anambra State is divided into 23 Local Government Areas. Each LGA consists of a number of communities. Communities are administrative and social entities, which in turn each comprise a number of villages.

The last population census originates from 1963. Projections have been made from those numbers, using a population growth rate of 2.5% per year for rural areas and 5% for the towns Enugu, Onitsha and Abakaliki. The projected population for 1990 is 7.7 million inhabitants (Ministry of Local Government, Rural Development and Chieftaincy matters, 1985). Figure 4.1 gives a map of the 23 LGA's and their population densities, annex 4.1 gives the corresponding figures.

A considerable difference in population densities can be discerned. Notable are two clusters of high population densities: first the area near Onitsha in the South-West of the State and second the area from Enugu up to the far North of the State. The remaining east to Central and West belt is less densely populated.

In the State as a whole, six built-up areas are officially designated as urban. These areas defined as towns are: Onitsha, Enugu, Nsukka, Abakaliki, Awka, Nnewi and Ihiala (RWSG, 1987). Onitsha is the trading centre of Anambra State and surrounding states.

4.2. THE IGBO: POPULATION AND SETTLEMENT PATTERNS

Anambra State is in the heart of what is known as Igboland. The Igbo are the third largest tribe in Nigeria and the largest tribe in East-Nigeria. Originally the Igbo people formed a group on the basis of their common language rather than being a political or social unity.

The Igbo are a patrilineal people, families are defined according to male lines. Men will marry women coming from other villages than their own. A woman is to follow her husband to his village of origin. A man and his wife or wives live within a compound. Polygamy is still practised among the Igbo, despite of their being Christians. The man and women (and grown-up sons) have their own house within the compound. As soon as the sons marry, they will built their own compound in the family's vicinity and within the village. Daughters will marry men from neighbouring villages and move to their husband's village. Men and their wives are independent to a certain extent. Both men and women have their own financial resources from agricultural activities or trade and may or may not share their income.

Since women are responsible for cooking, they are responsible for a large proportion of food supply. Men contribute both in kind and cash to meals. Men as well as women contribute to the children's upbringing.

Igbo's are known for their business spirit. Trade is a very important source of income, especially in the area around Onitsha. In the rural areas however agriculture still is the main source of income.

Present settlement patterns reflect the organization of Igbo Society. Today communities are clans made up of the descendants of one common (male) ancestor. The villages within a community each comprise the descendants of a more recent ancestor. An old and large village may be subdivided into kindreds (groups of families) which can develop into villages in future. The pattern of dispersed villages at a relative short distance together forming a community is only existing in the less densely populated areas. In the more densely populated areas the population pattern is less clear. Firstly, due to population pressure nuclear families are forced to find a place to live outside the cluster of their own kindred or even outside their own village. Secondly, villages and even communities extend until they join. An outsider notices continuous habitation and only the inhabitants can point out boundaries because they are known to them. In addition migration of people to trade centres and towns has changed the pattern as well.

Towns are defined as such on basis of the provision of urban services to its population; e.g. piped water supply, electricity, markets, postal services, solid waste collection and sewerage. Consequently areas lacking these urban facilities are considered rural, notwithstanding an urban character due to e.g. population number and density, settlement pattern and social and economical conditions. Many areas in the State officially designated as rural could be called semi-urban due to their urban i.e. build up character and need for urban facilities. With regard to water supply and sanitation systems low-cost rural solutions like handpumps and VIP latrines would be completely inappropriate. Local Government areas, where these officially rural but de facto urban situations can be found, are e.g. Nnewi and Njikoka.

The reverse can be found as well; the villages in outskirts of official towns may not be urban in character but rural. Although the town by right is to have piped water supply or even sewerage, the surrounding villages might be served equally well with rural solutions to water and sanitation problems.

4.3. THE EXISTING INSTITUTIONAL FRAMEWORK

4.3.1. INTRODUCTION

Since the administrative reforms of 1976 is the governmental administrative system in the Federal Republic of Nigeria a so-called three-tiered system, the highest level being the Federal Government, the lowest level being the Local Governments. Anambra State is one of the 20 states of the Federal Republic of Nigeria. All Nigerian states and the Federal Capital Territory of Abudja have a rather large degree of autonomy within the Federation.

As yet, Nigeria is in the process of transition from military government into civil government again. According the schedule this process will be completed in 1992.

4.3.2. STATE LEVEL

The highest official at state level is the military governor. Below the level of the military governor, state government is made up of a certain number of ministries and offices (for an overall organigramme see figure 4.2). Two main offices, both reporting to the Military Governor are the Cabinet Office, headed by the Secretary to the Military Governor, and the Office to the Military Governor, headed by the Principal Secretary to the Military Governor.

The state governmental system is a system of dual responsibility. This means that two different officials bear different types of responsibility for the same ministry or agency. For each ministry or agency, a for a period of approximately 2 years elected/appointed commissioner is bearing political responsibility. Administrative responsibility for each ministry or agency is borne by a director-general or director, a career civil servant. Both the commissioner and the administrative head of each agency report directly or indirectly to the Military Governor.

The highest board at state level is the Executive Council, made up of all commissioners and the Secretary to the Military Governor. Chairman of this council is the Military Governor.

Annex 4.2 gives information on the 1988 State Budget.

4.3.3. LGA LEVEL

<u>Local Government</u>

It is within the policy of the Federal Government to reinforce the autonomy of the local governments, thereby reducing some of the administrative power and influence which the state governments exercise over

the local governments. In order to have an idea about their financial means the so called estimates for the three selected LGA's are given in annex 4.3.

In a similar way as the state government, the local governments have also a system of dual responsibility. The chairman is the elected political head of the local government, the secretary is a career civil servant and is the administrative head of the local government administration.

For each department a principal officer acts as the administrative head, political responsibility is borne by four supervisory councillors. The councillors are elected and their councillorship is only a part-time job. For each department, the councillor acts as the chairman for the relevant bodies and committees on planning, monitoring and supervision.

In order to comply with the "Implementation Guidelines on the Application of Civil Service Reforms in the Local Government Service" (Federal Government of Nigeria, 1988), a great number of local governments face the problem to re-arrange the organization structure. In order to meet the (mandatory) guidelines, the number of operational departments is not to exceed four, the number of supporting departments is to become two.

Staff working within the Local Government are actually three different categories:

a. State government staff based in a Local Government. This staff is appointed by and on the pay-roll of the state government; this category mainly consists of professional staff, e.g. primary health staff.
b. Local government staff with higher grades. These staff make up the key job holders and skilled or trained staff of the Local Government. All this staff is appointed, promoted etc. by the state level Local Government Service Commission. This staff can be transferred too to other local governments or state bodies.
c. Local government staff with lower grades. Personnel management is mainly the responsibility of the Local Government.

Although both categories Local Government staff is mentioned in the yearly budgets ("Estimates"), the impression arose the lower staff are casual labourers only and not hired fulltime.

By far the most LGA's in Anambra State the population is made up of several communities or clans. The different communities may differ in habits, lifestyle, welfare, stage of economic development, etc. In some cases this can lead to friction. Some communities might feel they are not represented or the interests of their community is not properly dealt with in the local government politics and administration.

Other communities, generally the political and economical stronger ones, might be rather dominant and superimpose mainly their interests. In the ultimate case friction between communities can lead to splitting up one LGA into two or more. Although as yet not seen in Anambra State, this seems to happen regularly in the last few years in other (neighbouring) states: after a reduction of the number of LGA's and abolishing the districts within LGA's (a fourth tier) in 1976 the number of LGA's is again increasing for the sake of stability.

Zones

Although not being a separate administrative entity or tier, for mainly logistic purposes the entity "zone" has been created. This is the case for some state level agencies which provide facilities which have to be close to the beneficiaries, e.g. the Ministry of Health, the Ministry of Works and the State Water Corporation have zonal offices which serve a certain number of local governments.

4.3.4. VILLAGE LEVEL

The highest political, social and administrative unit among the Igbo in Eastern Nigeria has historically been the community. The clans formed autonomous city states. A centralized political organization, like a Kingdom or a State, never existed among the Igbo unlike for the Haussa and Yoruba populations (Awa, 1988). This absence of a higher level administrative organization can still be felt up to the present. People do not feel a strong sense of belonging to the LGA or the State. The community is the highest unit people feel a responsibility to. Within the community inhabitants are used to arrange for their own needs autonomously, not depending on the State or LGA to fulfil them. Through community efforts e.g. schools, town-halls, health centres, and even post-offices and banks are constructed throughout Anambra State.

Traditionally community power was never concentrated in one person or structure. It was shared by many organization structures of people. This way many were able to participate, discuss and involve in community affairs, decision-making and decision execution (Awa, 1988). Generally there were principal formal structures of community power, like the council of Elders, the Council of Titled Persons and the General Council (Town Assembly), who exercised formal power.
Supporting social groups strengthened the formal groups through mobilizing its members for action and participation in rule and decision execution. These groups were e.g. Age Groups, Societies of Mothers, Societies of Daughters, Secret Societies, etc.

By and large the present local administration and organization operates similar. Each community has some kind of formal power structure. This can either be a Council of Eldest (which in parts of the State still retained a lot of its importance), a Town Union Executive Committee (chosen by the General Assembly), a Community Development Union or a Council of Titled Men. A number of other organizations have a role to play in the execution of decisions made by the supreme council; Age Groups, Social Clubs, Women's Organizations, Cooperative Societies, etc. Additionally two individuals have their part to play. Firstly a Traditional Ruler, Chief or Igwe has his function and secondly a chosen Councillor plays a role.

Chieftaincy was an existing institution among the Igbo before the British Indirect Rule System was enforced. Under that rule however Chiefs were given more functions and power than before (Awa, 1988). Presently the institution still exists, although chiefs are no longer holding official responsibilities or power given to them by the State. At community level however chiefs are still powerful with considerable influence in local politics. Some communities regard their Traditional Ruler as the supreme local authority, while others merely see him as a patron or advisor to the ruling Council.

Under present administration each LGA is divided in a number of political wards. Per ward a Councillor for the Local Government is elected. Once someone is chosen Councillor, the man has influence and is likely to assert himself at community level.

It should be noted that although the general local administration and political organization is along similar lines throughout Anambra, the specific division of responsibilities and power over groups and individuals can differ considerably from community to community. One characteristic however is common: women are not involved in decision-making and politics in a formal way, although they do have influence through a variety of women's groups and informal channels.

Igbo seek consensus in decision-making as much as possible. Democracy and majority-vote are systems generally used in decision-making by Community Councils. Any group or individual can participate in council meetings and express their views. A ruling council typically meets twice to four times a month, some even twice a week. Once or twice a year a town meeting or general assembly is held. Any group or individual can make proposals for community (development) projects during these meetings. The ruling council however has the supreme authority. They are to approve of, amend, ratify and announce the plan.

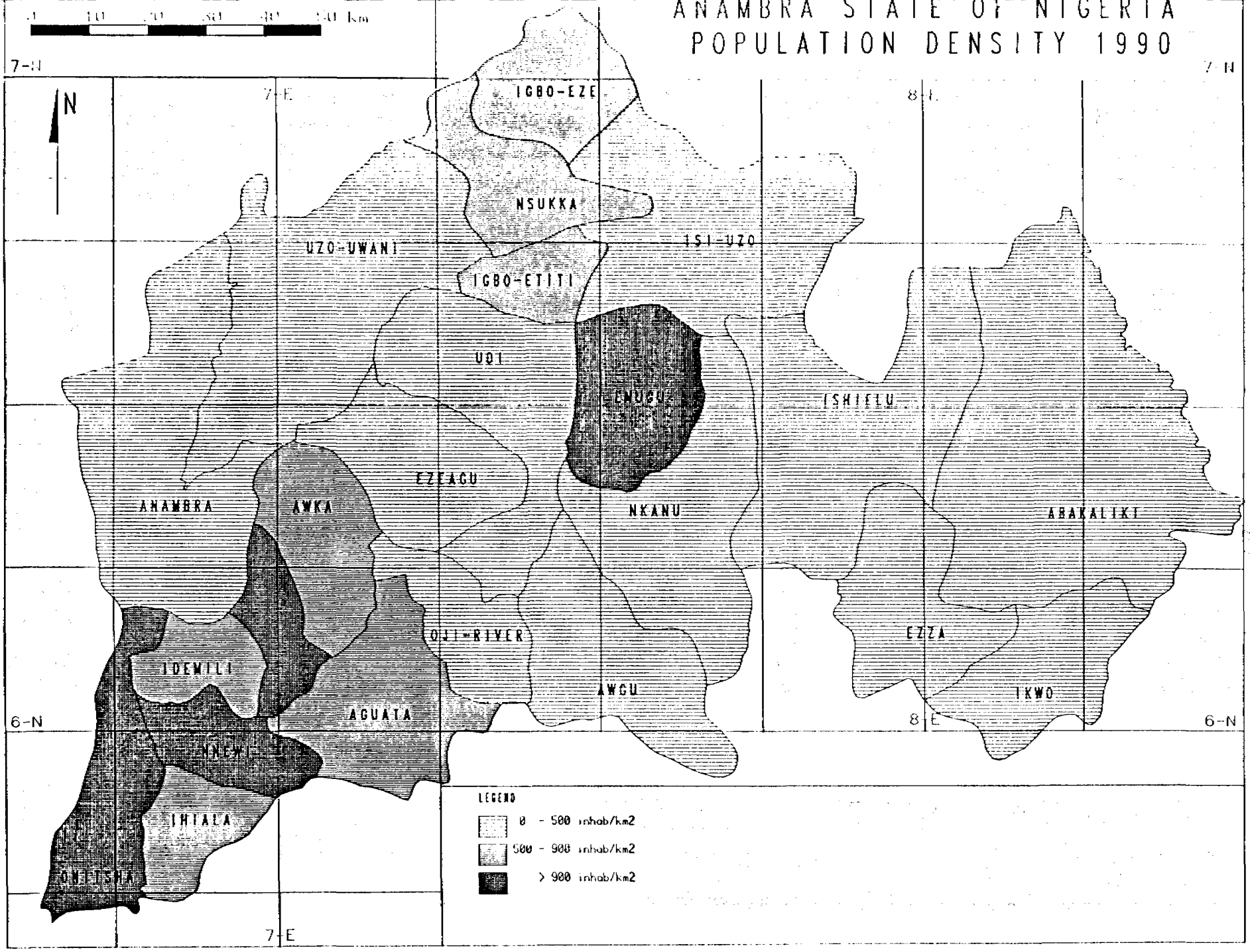
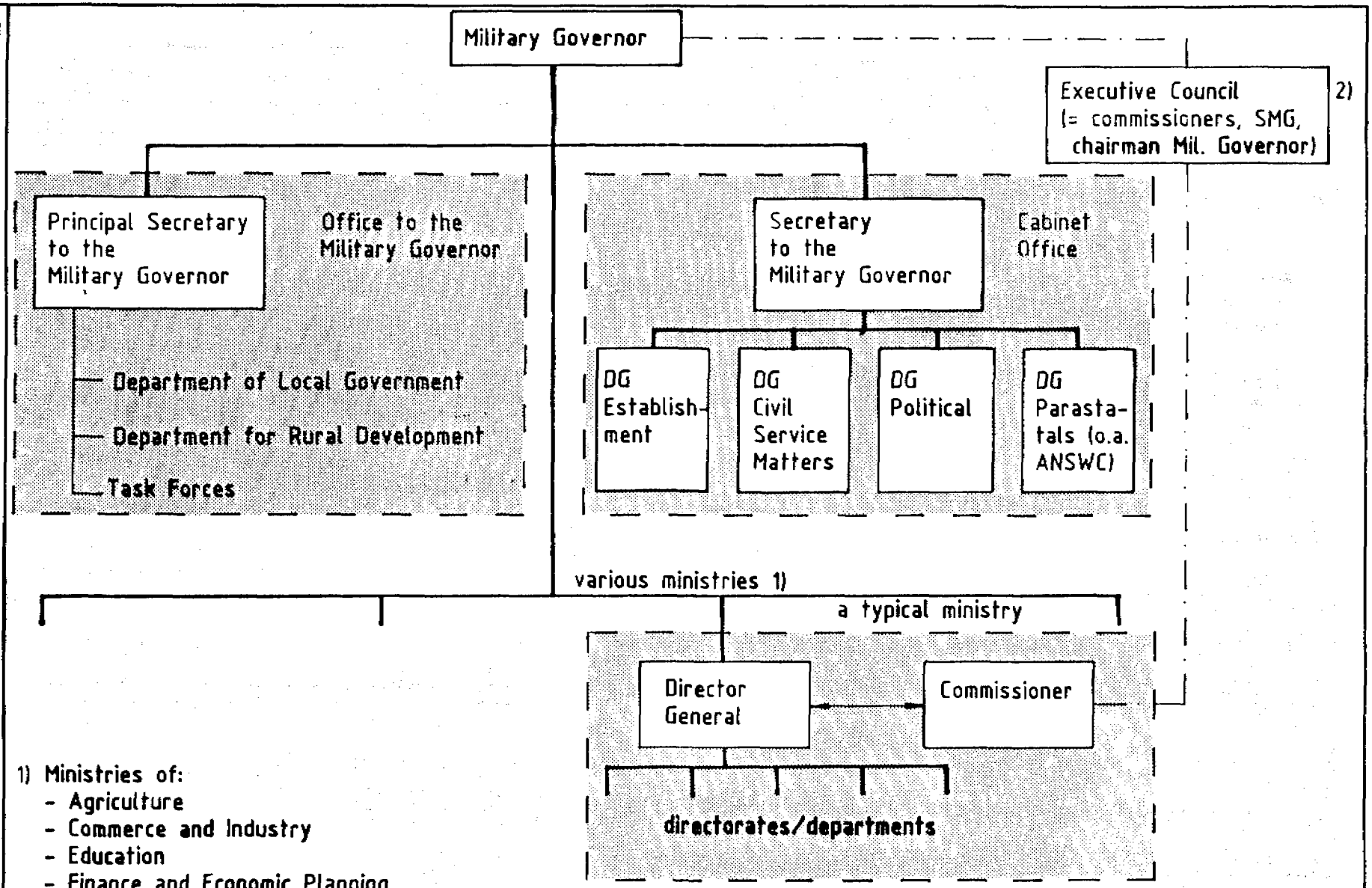

ANAMBRA STATE OF NIGERIA
POPULATION DENSITY 1990
N
7-N
7-E
8-E
6-N
IGBO-EZE
NSUKKA
UZO-UWANI
ISI-UZO
IGBO-ETITI
UDI
ENUGU
ISHIELU
EZEAGU
ANAMBRA
AWKA
NKANU
ABAKALIKI
OJI-RIVER
EZZA
IDEMILI
AWGU
IKWO
AGUATA
NNEWI
IHIALA
ONITSHA
LEGEND
0 - 500 inhab/km2
500 - 900 inhab/km2
> 900 inhab/km2

Figure 4.1



1) Ministries of:
- Agriculture
- Commerce and Industry
- Education
- Finance and Economic Planning
- Health
- Information, Social Development, Youth, Sports and Culture
- Justice
- Works and Transport

2) The Commissioner of Special Duties is not responsible for a certain *ministry, but separate departments* and organisations, such as Dpt. Local Government, Dpt. for Rural Development, State Water Corporation.

Client: RWSG , UNDP / World Bank

Project: RWS & S Anambra State , Nigeria

Description: Organigramme Anambra State Government

Drawn: HvD

Figure number: 4.2

Date: 04-'89

Approved: .

Drawing number: 1805-4.2

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The Netherlands

5. PRESENT RWS&S SITUATION IN THE STATE

5.1. CONDITIONS AND PRACTICES.

The largest proportion of the rural population by far, relies on traditional sources of water. Depending on the natural environment the sources and/or water supply systems are used are:
- springs, both natural and captated;
- rivers and streams;
- run-off storage pits;
- surface water reservoirs, both natural and improved ponds: used for collection of rainfall to serve a whole village;
- shallow wells and boreholes;
- deep boreholes with distribution
- individual rainwater collectors.

Local shallow wells can be found in the Eastern parts of the State but many can be used in the wet season only, since they fall. Rainwater is only used during the rainy season: rainwater tanks or reservoirs are rare due to their high cost. All other sources mentioned take care of the dry season's water supply in different area's of the State. In the hilly area's the relatively clean and safe springs are used. In large parts of the State however (East and far West) different forms of surface water are the only sources. Obviously these streams, ponds, rivers and reservoirs are open to pollution, infestation and contamination.

Few people in the rural areas have the opportunity or ability to supplement their supply with water from boreholes, let alone rely on it. Firstly borehole water is not distributed widely and secondly the price that converts into 15₦/m^3 or more is prohibitive to most of the rural families. Annex 5.1 lists prices of one m^3 for different forms of delivery in Igbo-Eze LGA.

Women, young women in particular, are responsible for day-to-day source management. This involves: weeding of the surroundings of and the source itself in case of rivers, streams, ponds or reservoirs; sweeping of the surroundings and supervision on the proper use of the source by children. Occasionally women hire men to do specific management tasks. Ponds, reservoirs and pits require redeepening every so many years. Work parties of both men and women may be involved in this task. In the case of spring captations villagers are responsible for the repairs or maintenance the source requires.

Both women and children carry water home. Water is transported in buckets, clay pots and jerrycans, either on the head or with bicycles. Water fetching hours are early in the morning and late in the afternoon, respectively before and after farm work or school. Average time spending on water fetching depends on both distance to the source and waiting time at the source.

Run-off water pits are generally dug near to the house, so time spending is limited as long as the pit supplies water. In other cases women or children have to travel up to 8 kilometer to fetch water from springs. In addition declining spring capacity towards the end of the dry season prolongs waiting time. Water fetching in these areas may take up to a half or sometimes even a whole day per family.

In areas where surface water ponds or reservoirs are used, the source is generally in the vicinity (1 to 3 kilometers) of the village (or one could say that villages have developed near an available water source). Provided the source did not dry, walking time as well as filling time are not seen as a problem. Wherever water is distributed by tankers and sold, women are immediately responsible for the costs although men contribute up to approximately half of the cost. Obviously time involved in water fetching during the rainy season is far less, since water is usually available near to the house.

At the house or compound, water is stored in (covered) clay pots, drums or jerrycans. Very few women treat the water before using it as drinking water. Alum is used sporadically to enhance sedimentation. Rarely water is boiled or filtered.

Bathing and laundering is done in rivers or streams. Where these are not available and sources are at a distance from the compound bathing and laundering is done near the source. Water transported to the house is mainly used for cooking, drinking, washing dishes and bathing small children. When sources are near to the village laundering may be done at the house. Where more than one source of surface water is available, specific ponds may be designated for bathing and laundering and others for drinking. Rain water and spring water are preferred as drinking water.

The problems regarding water as perceived by the rural population are the following:

- insufficient quantity of water during the dry season. Particularly in the North of the State the situation is acute during the dry season. Run-off water storage pits contain a limited amount of water which frequently needs to be rationed and still may not supply people to the next rainy season. Larger storage reservoirs and ponds in the East and West of the State frequently dry, but the situation is less urgent since alternative sources at far distance are still available. Spring capacity diminishes towards the end of the dry season, some springs even dry completely. The water available is rationed, but due to the first come first serve principle, people may have to wait up to a day to fill one jerrycan.

- poor quality of water during the dry season. Water from surface sources is considered inferior to rain water and spring water. Towards the end of the dry season ponds, reservoirs, rivers and streams increasingly give muddy and polluted water. Poor taste is perceived in large areas of the State a bigger problem than other quality parameters like source infestation or contamination. Only in the Guinea Worm (Dracunculiasis) affected areas people consider infestation as a quality problem.

- physical effort required to fetch water in the dry season. Women now and again complain about distance of the source and/or the time involved in water fetching, especially if a nearby source frequently dries or supplies insufficient water.

In short people perceive problems mainly in the dry season. The most important problem is the quantity of water available, poor quality and physical effort are perceived less important.

As opposed to water, sanitation is not perceived as a problem, let alone a priority in the rural areas. In the more densely populated, but still rural, areas people claim that approximately half of the compounds has some kind of latrine. In areas where habitation is less dense and more dispersed, virtually no household has a latrine. Reliable figures however are difficult to obtain since people are reluctant to admit their compound does not have one.

If latrines are existent the majority of them are of a traditional open pit type. In the North pit latrines are deep (15 m) to prevent flies and smell. The superstructure consists of mud block walls with a zinc roof or of thatch walls only. Generally these pits are equipped with either a concrete slab or a wooden floor. Villagers estimated a deep pit latrine with concrete slab, concrete block wall and zinc sheet roof would cost approximately 800 ₦. The digging of the pit itself is considered "expert" labour and costs 120 ₦.

In other parts of the State uncovered pit or trench latrines are used, usually with thatch walls and wooden floor or bar.

5.2. EXISTING INSTITUTIONAL FRAMEWORK IN THE SECTOR

Various organizations and agencies are involved in the rural water supply and sanitation sector but none has an overall coordinating responsibility. As already described in chapter 4.3, organizations and responsibilities are rapidly changing and often related to availability of funds at a specific moment. More detailed information is given in annex 5.2. Here an overview is given of the most relevant organizations:

The Anambra State Water Corporation (ANSWC) has a Rural Water Supply Section. This Section operates water schemes in the more densely populated areas that will in the scope of this study be classified as semi-urban.

The State Department for Rural Development (DRD) is the planning and monitoring body for all rural development activities in the State, theoretically including RWS&S.

The Rural Development Authority (RDA) is an organization in charge of programme execution. Most of it is done under contracts. Villages or communities can apply for technical and financial assistance for execution of projects. In case of a positive decision RDA pays 60% of the costs, the village itself 40%.

The activities of the Agriculture Development Project ADP are scattered throughout the State and mainly of agricultural nature. Some pilot water supply will be executed in the near future.

The Anambra State Ministry of Health (MOH) is in two ways involved in the RWS&S sector:

a. by its health education staff
b. through the UNICEF and JICA assisted projects for RWS&S.

Local Governments have theoretically responsibilities for RWS&S but their actual involvement is zero in practice. It is Federal policy to change this situation.

The Federal Department of Water Resources manages a rural water supply project. It has a task of permanent data collection and of the setup of a policy for water resources management.

The activities of most agencies concern preparation and realization of new works. Only ANSWC is involved in operational maintenance.

5.3. ONGOING AND PROPOSED SECTOR PROJECTS

A detailed description of the ongoing and proposed sector projects and related activities is given in annex 5.3. The most important ones are listed in the table 5.1. Apart from these the ANSWC foresees considerable investments in water supply schemes in areas that are in this report considered as semi-urban.

TABLE 5.1: THE MOST IMPORTANT ONGOING AND PROPOSED PROJECTS IN THE RWS&S SECTOR.

PROJECT NAME	OBJECTIVE	LOCATION	STATUS
National borehole programme (by Fed. Dept. of Water Resources)	52 piped schemes	all LGA's	13 commissioned funds for achievement unclear
DFRRI 250 communities (by RDA)	250 shallow boreholes	all LGA's	most of it completed, but low success rate.
UNICEF WATSAN (by MOH)	300 shallow boreholes, VIP latrines	Ishielu, Abakaliki LGA	just started
JICA (by MOH)	150 shallow boreholes	Aguata, Ezza and Ikwo LGA	to start June '89

The National Borehole Programme has been started up on Federal funds and aims to construct the schemes only. The policy for priority ranking is unknown so far.

The DFRRI programme is on Federal funds as well. The approach has been to construct 50 m deep boreholes, equally spread over all the LGA's. No activities have been undertaken in the field of community mobilization.

The UNICEF assisted WATSAN project is the only one that integrates technical aspects of water supply and sanitation with community involvement and health education. Guinea Worm eradication is the main objective. The construction of 10 VIP latrines by the villagers with technical support of the project is a condition for the start of the construction of a borehole.

The JICA funded borehole programme aims at Guinea Worm eradication as well, but will result in construction of shallow boreholes only.

6. NEEDS

The order of magnitude of the volume of operations to achieve a long term and sustainable improvement of the RWS&S has been determined on the basis of the size of the target group in the year 2000 or 2005 and a specific consumption of 20 l/c/d. In line with the Federal policy (Okeke, 1988) a coverage of 60% is assumed.

In order to quantify the target population for rural water supply the projected population for the year 2000 has been taken from which all urban or semi-urban population has been subtracted (see table 6.1 hereafter).

The urban population with existing project schemes has been derived from data supplied by the ANSWC and included in the Tahal Consulting Engineer's technical proposal 1988. Though it is known that the estimated coverage five years ago was approximately 60% it is thought that this figure has been considerably reduced at the same time as the urban population has increased by an estimated 5% per year. The figures given in table 6.1, column 2 are the total 1990 urban population figures where there are existing schemes. The needs of the urban section of the population is deemed to be outside the terms of reference of this study, though they are thought to be considerable.

The non urban population with existing schemes has also been derived from data supplied by the ANSWC of their schemes, dated 1984, together with additional information of schemes completed under the National Borehole Programme up to 31 December 1988 and those completed by the Rural Development Authority. It is estimated from their data that the existing ANSWC schemes are only covering approximately 25% of their designed population. However up to date information is non existent and must be obtained through a separate and more detailed study. It is acknowledged that there exists a great need for water by this section of the population however with lack of available information detailed needs are impossible to ascertain.

The non urban population with planned schemes has been derived from existing proposals put forward by the ANSWC to the African Development Bank for funding together with proposed and ongoing schemes coming under the responsibilities of the National Borehole Programme (NBP), the Rural Development Authority (RDA) 1988 and the Agricultural Development Programme (ADP) 1986.

TABLE 6.1: POPULATION OF ANAMBRA STATE NOT COVERED BY EXISTING AND PLANNED URBAN AND SEMI-URBAN WATER SUPPLY SCHEMES

LGA name	Population 1990	urban population with existing piped schemes	non urban with existing schemes	non urban with planned schemes	year 2000 popula- tion not covered	% of year 2000 popu- lation not covered	'rural' popula- tion
Abakaliki	462,224	110,000	24,000	350,836	106,811	18%	106,811
Aguata	486,969	229,000	62,159	181,358	150,803	24%	150,803
Anambra	**387,240**	**0**	**70,000**	**243,634**	**182,033**	**37%**	**182,033**
Awgu	332,326	0	71,000	137,230	217,147	51%	217,147
Awka	430,088	110,000	0	211,044	229,469	42%	229,469
Enugu	586,856	927,000	**0**	63,942	(239,766)	-32%	0
Ezeagu	214,616	25,000	**73,000**	139,005	37,703	14%	37,703
Ezza	271,786	0	0	116,756	231,130	66%	231,130
Idemili	212,493	**0**	152,444	241,608	(122,061)	-45%	0
Igbo-Etiti	232,240	**0**	142,000	124,864	30,403	10%	30,403
Igbo-Eze	**307,980**	**0**	**78,000**	**173,702**	**142,512**	**36%**	**142,512**
Ihiala	266,800	0	70,000	212,606	58,898	17%	58,898
Ikwo	**170,598**	**0**	**0**	110,335	**108,030**	**49%**	108,030
Ishielu	373,481	33,000	0	68,643	376,413	79%	376,413
Isi-uzo	272,957	0	60,000	190,465	98,920	28%	98,920
Njikoka	489,825	0	337,491	314,891	(25,406)	-4%	0
Nkanu	301,718	90,000	0	172,055	124,144	32%	124,144
Nnewi	354,235	0	182,749	207,153	63,519	14%	63,519
Nsukka	346,819	130,000	129,000	176,447	8,481	2%	8,481
Oji-River	119,095	0	69,000	100,503	(17,061)	-11%	0
Onitsha	673,282	500,000	0	54,610	307,191	36%	307,191
Udi	210,158	35,000	**139,185**	134,391	(39,574)	-15%	0
Uzo-Uwani	229,521	0	0	200,844	92,943	32%	92,943
Total	7,733,307	2,189,000	1,660,028	3,926,922	2,122,683	21%	2,566,551

Estimated coverages for each of the communities has been made at 60% with each of the NBP and RDA projects estimated to cover a maximum of 12,000 in the light of no other accurate information being available and referring to the Federal Governments national policy of 60% coverage of water supply and sanitation for rural communities in the year 2000. Information of the ADP pilot projects do suggest approximate population coverages.

The populations which are not covered by any existing or planned schemes have been derived by summing the total population which have existing schemes together with those that have planned schemes and subtracting that sum from the projected year 2000 population for each LGA. The negative or bracketed figures identify those LGA's where over design coverage will take place. The over design figures are reduced to zero in the final column which then illustrates the target group to be covered in each of the LGA's.

The 2.57 million people are the 'rural' population without RWS&S facilities in the year 2000. It is thought that this group might err on the low side because of the assumption that all planned projects are carried out.

As said it is a Federal policy to cover 60% of the rural population with adequate facilities. If the planning horizon is taken later this rural population will have grown as well with 2.5%/year. A planning period of 15 years would result in another 13% of people to serve. By that time the desired coverage percentage may have gone up and the specific consumption as well. This may triple the quantities of water needed.

It must be stressed that these figures are based upon proper operation of existing ANSWC schemes and realization of their planned schemes. This supposition will also require an extensive input for the ANSWC in the form of the planned rehabilitation, institutional strengthening and construction programmes.

The distribution of the rural population over the hydrogeological zones is derived from the preceding tables 6.1 and 6.2 and shown in table 6.3:

It can be seen that in the first hydrogeological zone the needs are the highest. It is here that two programmes are already active: the UNICEF assisted WATSAN project foresees to create 300 shallow boreholes, and a Japanese funded project another 150. These 450 shallow boreholes can potentially serve between 135,000 to 225,000 people or 12% to 20% of the target group in the hydrogeological zone. It is also in this area that Guinea-worm is endemic, and therefore it is by no accident that these two projects have their activities here.

TABLE 6.3: DISTRIBUTION OF RURAL POPULATION OVER HYDROGOLOGICAL ZONES

Hydrogeological zone number	Rural population * 1000 (year 2000)	% of rural pop. to be served
1	1,149	45 %
2	261	10 %
3	187	7 %
4	394	15,5 %
5	576	22,5 %
	2,567	100 %

General guidelines of priority ranking of the LGA's cannot be given on the basis of the actually available data. A baseline survey of all LGA's can clarify the situation of demography, health conditions, actual level of facilities etc., which can make priority ranking more simple.

7. CONSTRAINTS

7.1 INSTITUTIONAL CONSTRAINTS

The most serious problem that hampers the development of the RWS&S sector is the weak coherency of activities. At State level various agencies have activities and very capable staff in this field but there is no proper planning and coordination.

At LGA level there exists still little expertise in the sector, but it is Federal policy to make LGA's responsible for RWS&S development.

According to the traditional power structure the communities and villages are not easely contacting the State Government for their RWS&S problems, that are in many cases too complex to solve them without assistance. Besides a certain mistrust exists at village level to invest in low technology RWS&S facilities because of failures in the past.

These institutional constraints can be resolved by the following activities:

- The set-up of a State Agency that will be overall responsible for planning, monitoring and coordination of RWS&S activities.
- Implement the Federal policy to make the LGA's responsible for RWS&S development trough external support.
- Training of staff at both levels.

7.2. PRACTICES FOR OPERATION AND MAINTENANCE

Operation and maintenance of water supply facilities is done either by ANSWC for mechanized systems or by villagers for hand operated systems.

In theory ANSWC is capable for this task, but in practice maintenance is done at a minimum level due to lack of funds and spare parts. ANSWC has already proposed an increase of water tariffs to improve this situation, but it is questionable if this will be enough. Many of the installations require import of spare parts and the proposed increase of water rate is not yet in pace with recent drops of value of the Naira on the foreign exchange market.

Training of staff and institutional strengthening of ANSWC can be a second tool to improve the situation of operation and maintenance.

The simpler hand operated systems are handed over to communities of villages after construction.

Lack of involvement of the future beneficiaries during preparation and construction phase results in their passive attitude towards maintenance. Community mobilization and health education must create the demand for RWS&S facilities prior to their construction and involvement of the future beneficiaries in construction costs will make their responsibility for operation and maintenance much easier to accept.

7.3. AVAILABILITY OF FUNDS

Two types of funds must be distinguished:

- funds for construction of new works;
- funds for operation and maintenance.

In the villages and communities people are used to contribute to construction of communal facilities but not on a large scale of RWS&S facilities. This can be explained by too high costs, the already mentioned fear for failures or the low priority given to it.

At LGA level almost no funds are available for RWS&S. At State level the available funds for RWS&S are limited. The 1988 estimates show 110 million Naira for capital projects in rural areas but this includes much more than RWS&S. About 56 million Naira is allocated for water resources and supply, but most of it was reserved for expansion of the greater Onitsha Water Supply Scheme. Twelve million Naira has been earmarked for real RWS&S purposes, i.e. less than 1 $/cap/year.

The solution for this problem must be found in either reallocation of State funds towards the sector or external support, Federal or foreign. Okeke (1988) mentions that all levels must contribute, but that Federal Government should provide the bulk of the funding.

As explained in the previous paragraph operation and maintenance is partly hampered by lack of funds and partly because of responsibility for it is not defined prior to construction.

The first problem can be solved if a strict cost recovery policy is applied. A condition is that recurrent costs correspond with ability and willingness to pay for water. From the 9 sample villages visited an impression has been obtained on this subject (see table 7.1).

TABLE 7.1: INCOME, ABILITY AND WILLINGNESS TO PAY FOR WATER SUPPLY IN SAMPLE VILLAGES

LGA	COMMUNITY	ANNUAL INCOME PER FAMILY ₦	WILLINGNESS TO PAY FOR WATER ₦/MONTH /FAMILY
Anambra	Nzam	1000-4000	10-15
	Nkwelle	500-3000	10-20
	Ezi Agulu Otu	2000-4000	10-15
Igbo-Eze	Uhunowerre	1200-1600	4- 7
	Umu-Ozzi	1400	4- 7
	Itchi	1200-1400	15
Ikwo	Ekpelu	4000-5000	8
	Echialike	> 5000	8-10
	Ndufu Alike	4000	4- 7

8. OPTIONS

8.1 WATER SUPPLY OPTIONS

Table 8.1 gives an overview of the most appropriate options for water supply in the five hydrogeological zones. The number of people that can be served by one scheme are estimates based on the assumption that one waterpoint (handpump, tap) can serve 300 people and the specific consumption is 20 litre/cap/day. For the deep boreholes with mechanical pumps the potential of the aquifer has been taken into account: in zone 2 a borehole can easily supply 50 m^3/hr or 400 m^3/day and allows 20,000 people to be served. The water needs to be distributed in that case over 22 public standposts with 3 taps each.

In zone 3 the aquifer has a lower potential so the average yield of one borehole is estimated at 30 m^3/hr. In that case 12,000 people can be served, and distribution over 13 public standposts of 3 taps each is necessary.

In order to translate rural population quantities into number of installations to be constructed a method has been used that is described in annex 8.1. In this annex it is assumed that the target group is 60% of the rural population and that specific consumption is 20 l/c/d. If the values of these parameters are varied an extrapolation can be done as indicated in table 8.2. In this table numbers of works to be constructed are extrapolated with the following assumptions:

A hand operated system is 8 hours/day operational, and a handpump supplies approximately 700 litre/hour. If specific consumption or coverage are increased, the number of works will increase proportionally.

The deep boreholes are assumed to operate 8 hours a day. If specific consumption rises a larger reservoir can be constructed to allow pumping during more than 8 hours/day. The number of schemes depend than less of the specific consumption.

From point of view of the slow actual speed of RWS&S developments it seems most realistic to choose a minimum scenario for the Strategic Plan i.e. 60% coverage and 20 l/cap/day specific consumption by the year 2000 or 2005.

TABLE 8.1: MOST APPROPRIATE OPTIONS FOR RURAL WATER SUPPLY PER HYDROGEOLOGICAL ZONE (AFTER UMA AND EGBOKA, 1988)

ZONE	NATURE OF SUB SOIL	MAIN WATER RESOURCES	MOST APPROPRIATE SCHEMES FOR RURAL WATER SUPPLY	MAX NUMBER OF PEOPLE TO BE SERVED BY ONE SCHEME
1	mainly shales	shallow ground water	hand dug wells	300
			shallow boreholes	300
		some springs	spring captation	600
		impounded surface water	bulldozer dug ponds with slow sand filter and pump	4,000
2	mainly sandstones	deep ground water	deep boreholes with overhead tank and some reticulation	20,000
		some springs	spring captation, but will in most cases be far away from settlements	600
3	sandstones	ground water	boreholes with handpumps	300
			handdug wells	300
		deep ground water	deep boreholes with overhead tank and some reticulation	12,000
		springs	spring captation	600
4	shales	shallow ground water	boreholes or	300
			handdug wells with high rate	300
		deep artesian ground water	expensive boreholes, low operational costs	12,000
		impounded surface water	bulldozer dug ponds with slow sand filter and pump	4,000
5	sandstones, sands, and alluvial deposits	ground water	boreholes/ handpumps	300
			handdug wells	300
		springs	spring captation	600
		shallow ground water under alluvial plains	handdug wells	300

TABLE 8.2: ESTIMATES OF NUMBERS OF WORKS TO BE CONSTRUCTED TO COVER STATE RURAL POPULATION

Planning horizon (year)	2000		2005		
Rural population ($*10^6$)	2.57		2.91		
Specific consumptions (l/c/d)	20	30	20	30	40
Coverage	60%	100%	60%	80%	100%
Target population ($*10^6$)	1.53	2.55	1.75	2.33	2.91
Numbers to be constructed					
Hand dug wells	1835	4587	2073	5183	6910
Shallow boreholes	1556	3890	1758	4395	5860
Spring captations	27	68	31	78	103
Ponds	82	205	93	205	310
Deep boreholes	10	17	12	16	19

Estimates have been made of investment, maintenance and operation costs for the technical options proposed (see table 8.3). More detailed information can be found in annexes 8.2, 8.3 and 8.4.

Cost estimates for the construction of the various types of works have been made (see annex 8.2), assuming execution by a contractor, but excluding costs of community involvement, preparation of works, supervision and training. Multiplication of the unit prices with the miminimum number of schemes to be constructed gives the results for the whole state and for the three selected LGA's as indicated in table 8.4.

TABLE 8.4: CONSTRUCTION COSTS OF SCHEMES TO SUPPLY 60% OF THE RURAL POPULATION WITH WATER

OPTION	UNIT PRICE NAIRA	ESTIMATED CONSTRUCTION NEEDS			
		STATE		3 LGA'S	
		NUMBER	INVESTMENT NAIRA	NUMBER	INVESTMENT NAIRA
hand dug wells	29,000	1,835	53,215,000	396	11,484,000
shallow boreholes	76,000	1,556	118,256,000	117	8,892,000
spring captations	30,000	27	810,000	5	150,000
bulldozer dug ponds	85,000	82	6,970,000	6	510,000
deep boreholes	2,236,000	10	22,360,000	4	8,944,000
			201,611,000		29,980,000
EXCHANGE RATE (NAIRA/DOLLAR)		7.4			
TOTALS IN US$			27,244,730		4,051,351

Table 8.3 COST OF VARIOUS STANDARD DESIGNS

	Population Coverage	Capital Cost N	Cost/ Capita N	Maintenance Cost/year N	Maintenance Cost/capita /year N	Depreciating Cost/year/ N	Depreciating Cost/capita/ year N	Annual Running Cost	Annual Running Cost/ capita	Total Annual Cost/capita	Cost/ m^3
Hand dug well, including lining hygienic slab and pump, 15 m deep on average	300	29000	96.7	600	2.00	2200	7.33	3000	10	19.33	2.80
Shallow borehole, complete with lining, hygienic slab and handpump up to 50 m deep	300	76000	253.3	400	1.33	5334	17.78	3000	10	29.11	4.14
Spring captation, including standard box taps and apron.	600	30000	50	60	0.10	2000	3.33	1500	2.5	5.93	0.81
Catchment pond (18000 m^3 capacity) with slow sand filter and pump	4000	85000	21.25	1850	0.46	4800	1.23	3000	0.75	2.44	0.33
Borehole 300 mm, 175 m deep with submersible pump, genset, elevated tank and 9 km reticulation and 33 standpipes	20000	2236000	111.8	67080	3.35	129600	6.48	38725	1.94	11.77	1.61
Ditto, but 250 mm, 150 m deep, 6 km reticulation and 20 standpipes	12000	1512000	126	45360	3.78	91966	7.66	31025	2.59	14.03	1.92

Note on Cost :

1) Handpump based on India MK II @ $ 320 UNICEF recommended maintenance cost @ $ 100/year, pumplife 5 years
2) Hand dug wells will require deepening periodically say N 200/year
3) Spring captation maintenance will consist of replacing taps
4) Slow sand filter will require replacement sand
5) Typical annual maintenance cost of a borehole/reticulation scheme is 3% of total capital cost and include wages
6) Annual running cost includes pump attendants or operators/maintenance mechanic wages and fuel costs
7) In the case of the first four options attendants are not required full time and wages are reduced accordingly

From the surveys in the sample villages (see table 7.1) it is learnt that on average a family is willing to pay approximately 10 ₦/month i.e. 120 ₦/year. Total annual costs vary between 30 and 2.5 ₦/cap. so with 6 persons/family between 180 and 15 ₦/family. It can be concluded that these annual costs/family correspond in order of magnitude with the willingness to pay.

A second step is to make sure that beneficiaries pay such amounts to cover full operation and maintenance on a regular basis. It is recommended to make arrangements through Village Water Associations. Indications are that a flat rate system would be preferred, especially by women (who appear to expect this to result in a more equitable sharing of the cost of water between men and women). Flat rate systems are also practised by the public sector for urban schemes but not for rural schemes where individual transactions on a cash basis are the rule. Such a system is impractical however because the recurrent cost per 25 l container amounts to 2 kobo only and coins of less than 10 kobo are virtually non-existent. A ticket/coupon type of scheme is considered too cumbersome since this would require a full-time ticket collector.

Communities are also expected to be able and willing to pay for some of the cost of depreciation and thus assume responsibility for the payment of (part of) the capital cost.

At present, repair and replacement of equipment items cannot be guaranteed by Government Authorities as their budget contains insufficient funds to cover recurrent costs. Indeed, the most frequent cause of malfunctioning and interruption of water supplies is the non-repair of broken-down equipment.

The proposed approach therefore is for communities to assume responsibility for the financing of capital cost items with an expected short-to-medium-term life. Communities have been capable of collecting funds sufficient to cover the cost of buying and replacing generator sets, presently costing about ₦ 150.000, i.e. ₦ 7.50 per person or ₦ 37.50 per family of five, as evidenced in a number of recent cases where villagers collected similar sums for e.g. school or road construction. Payment on a daily or monthly basis would be more difficult since the burden would fall on the women responsibility for collecting the water. Fund-raising on an ad hoc basis is therefore preferred.

The disadvantage of this approach is that those communities where boreholes are the best solution for improving the water supply will pay more than others. The amount of money is small however (₦ 9.50 and ₦ 0.50 per person are the two extremes) and the difference can be made up to some extent, but the necessity of transferring responsibility for repair and replacement of handpumps, submergible pumps and generators to the communities is primordial.

8.2 SANITATION OPTIONS

As mentioned the sanitation coverage in the rural areas is very limited. Possibly two per cent of the households have what would be classified an hygienic latrine and by this one would be describing a latrine with a concrete cover slab which is regularly swept and kept clean. There are no ventilated improved pit (VIP) latrines except the very few that are being constructed under the UNICEF assisted WATSAN project. The few traditional latrines that have been constructed are by and large only holes in the ground with a rudimentary screen around them and therefore are extremely unhygienic. The vast majority of the rural population continue to use the bush.

The WATSAN project has advocated the use of the alternating VIP latrines. If used as a multi compartment communal latrine especially at market or community centres then this solution does have merit, provided the maintenance of such installations are well defined and in particular that a full time paid latrine attendant is available. However to propose the alternating VIP latrine as an individual family latrine would be unwise from an willingness to pay point of view. This is especially the case if it was made as a precondition of being eligible for a borehole.

A comparison of estimated latrine costs as shown in table 8.5 illustrates the relative high cost of an alternating VIP at ₦ 1,814 compared with other lower cost options which are as little as ₦ 84. Considering that at present sanitation improvements are not seen as a priority by the rural population the adoption of such an expensive solution as an initial introduction to individual family sanitation should be reconsidered. The maximum indicated income in the three LGA's under study was found to be in the order of ₦ 4,000 in Anambra LGA. The majority of incomes however are well below that and there is virtually no disposable income.

A more acceptable solution would be to encourage the construction of the Moçambique type latrine either with the tight fitting plug or without the plug but with blockwork vent pipe. Apart from the considerable reduction in cost, from a community involvement point of view the adoption of such solutions have the advantage of employing the greatest amount of unskilled labour or potential self-help as a percentage of the cost of the latrine. In the case of the basic Moçambique type latrine design this amounts to 72% whereas with the alternating VIP latrine it is only 5%. This is because of the comparatively higher proportion of material and skilled labour required to construct the latter.

The higher the percentage of self-help the greater will be the perception of ownership which in time can lead to greater acceptability, sustainability and ultimate success of the sanitation component of a project. The converse will occur as the degree of community involvement decreases. Based upon discussions with WATSAN staff there are already indications that not only is the individual latrine component of their project unaffordable to the rural community but because it is also being made a condition to have a number of such latrines as a prerequisite to having a borehole there is a danger of rejection of the water component as well. The detailed cost estimates of the various individual latrine options together the a five compartment communal alternating pit latrine are to be found in annex 8.4 together with suitable illustrative sketches.

In areas where people spend considerable time living and working in the fields, though on a temporary basis, consideration must be given to encouraging them to dig shallow pits approximately 1 metre deep, to defecate in rather than indiscriminately using the surrounding bush. Earth should be placed over the excreta every time defecation has taken place and once the pit has filled to within 0.5 metre of the surface it should be completely backfilled and a new shallow pit excavated. By concentrating the excreta in one location and minimizing the possibility of faecal contact an improvement in the general sanitation level will take place.

In such circumstances it is very unlikely that resources would be available to construct a permanent hygienic latrine and the excavation of a shallow pit would therefore be a considerable benefit to improved sanitation.

The minimal construction costs of sanitation facilities can be determined in the same way as the water supply costs. The cheapest option is taken, again a coverage of 60% is used, with a density of 1 facility per 10 persons. Basically in the hydrogeological zones 2, 3 and 5 a lining is needed, while in the shale areas of zones 1 and 4 this lining may not be necessary. This way the global construction costs have been found for the required sanitation in Anambra State as indicated in table 8.6.

TABLE 8.5: SUMMARY OF COSTS OF VARIOUS LATRINE OPTIONS

Latrine type and description	Located in stable soil condition		Located in unstable soil condition	
	Naira	US $	Naira	US $
1. Moçambique type to slab level only, excluding cost of unskilled labour.	83	11	466	63
2. Moçambique type to slab level only but with block vent pipe, excluding cost of unskilled labour.	148	20	531	72
3. VIP latrine to slab level only excluding cost of unskilled labour (UNICEF design)	388	52	786	106
4. Alternating VIP latrine to slab level only, excluding cost of unskilled labour (UNICEF design)	1814	245	1814	245
5. Ditto including block superstructure	2547	344	2547	344
6. Ditto including 5 compartment block superstructure	12849	1736	12849	1736

Note: US $ 1.00 = ₦ 7,4 mid February 1989.

TABLE 8.6: CONSTRUCTION COSTS OF SCHEMES TO SUPPLY 60% OF THE RURAL POPULATION WITH SANITATION FACILITIES

Hydrogeological zone	Population	number of facilities	unit price (Naira)	amount zones (Naira)
1 and 4	1,543,000	92,580	83	7,685,000
2, 3, 5	1,024,000	61,440	466	28,650,000
Exchange Rate (Naira/Dollar) 7.4				
Construction costs in Dollar:				4,910,000

9. OBJECTIVES

9.1. GENERAL OBJECTIVES

General objectives of the proposed Strategic Plan for RWS&S development are to improve health and living conditions of the rural population in Anambra State.

A short term Plan of Action proposed in Volume 2 aims to initiate the activities of the Strategic Plan and to create operational capacity to continue them.

9.2. POINTS OF DEPARTURE

The following points of departure can be formulated for a Strategic Plan for rural water supply and sanitation in Anambra State:

1. Actual water supply and sanitation facilities in the rural areas are at a very low level from point of view of quality, quantity and distance from consumer to the source.

2. Sustainable RWS&S sector development can only be achieved by responsibility of beneficiaries for all operation and maintenance.

3. Communities will take up this responsibility only if they feel owner of the system: some form of villagers' contribution towards costs of construction is necessary to create this feeling of ownership.

4. External funds will be necessary for initial investments: from LGA, State, or Federal Government budgets or foreign donors.

5. Community mobilization and health education activities must be an important part of this external support. They must be directed towards generation of the villagers' demand for RWS&S facilities.

6. Sanitation is given low priority by villagers. Generation of demand for sanitation facilities will require much more time than for water supply facilities.

   As health education and construction of simple latrines do not require an large input from external donors, it should not be tried to keep construction of sanitation facilities in pace with construction of water supply schemes. The availability of a revolving fund can be helpful for the LGA's to assist the villagers with the construction of sanitation facilities.

7. Priority ranking of LGA's or of villages within an LGA cannot be done on the basis of actually available data. The proposed baseline survey should improve this situation. Criteria for priority ranking have been proposed by RWSG (1987): needs, ability and willingness to pay and implementation efficiency.

9.3. AIMS/ GOALS

The objectives that underlay the RWS&S development are the following:

1. to improve the public health situation by realization of RWS&S facilities with the active involvement of the local population in decision making, implementation, operation, and maintenance of local water supply and sanitation facilities.

2. to design and implement village level facilities with a strong emphasis on sustainability, village level operation and maintenance (VLOM), and replicability, so as to safeguard the continued and proper use of constructed facilities in the post project period.

3. to strengthen local institutions at village, LGA, and State levels as well as the private sector, so as to enable them to accommodate requests from villages for advice and assistance in the design, construction, operation, and maintenance of WS&S facilities to be constructed in the course of the village level project mentioned in (1).

4. to support the project's village level actions by the design and execution of a village level health education programme and by stimulating villages to undertake communal health oriented activities.

5. To undertake activities by LGA's so that experience gained is passed through to other LGA's

10. ACTIVITIES

10.1 INTRODUCTION

The main activities to achieve the goals of the Strategic Plan are:

1. Baseline surveys in all LGA's for detailed knowledge of the situation and of the needs for RWS&S facilities per LGA.

2. Support of a State wide operating unit for planning, monitoring and coordination of RWS&S development activities.

3. Support of LGA's to prepare and implement village level projects to create RWS&S facilities.

4. Financial support of construction costs of water supply facilities.

5. Monitoring and evaluation.

The core of the activities should be at village level, organized per LGA. Table 10.1 represents a matrix of stages and functions of such a village level RWS&S "project"

10.2. DESCRIPTION OF THE ACTIVITIES

10.2.1. Baseline survey, monitoring and evaluation

The baseline survey should cover three issues:
1. Identification of target group;
2. Determine actual water resources and water supply and sanitation practices and needs for improvement felt by the rural population;
3. Quantify the time actually spent on water collection.

The first two points are necessary to determine the number of people to be served and for priority ranking of the villages. The third point is included in the baseline survey to allow a quantification of the impact of the project after it has been completed.

Monitoring should consist of repeated survey of time spent on water collection, knowledge of good health practices, number of VWA's etc.

In order to obtain reliable maps for project execution it is important to spend considerable effort in procurement and interpretation of aerial photos and/or satellite images (see annexes 10.1 and 10.2). Annex 10.3 describes the proposed approach for identification of the target group, based on interpretation of satellite or aerial pictures in combination with a field survey.

10.2.2. Support State unit for planning, monitoring and coordination.

Support of this unit must mainly consist of on-the-job training, assistance and logical support. The proposed tasks for the unit are described in the section on institutional setup.

10.2.3. Support of the LGA's

Like the staff of the state wide operating unit for RWS&S the permanent staff of the LGA's will need training, assistance and support as well. It is likely that the actual permanent LGA staff has little knowledge in this field, so in the beginning responsibility for project execution will be completely with the temporary project staff. Gradually this responsibility can be transferred to the permanent LGA staff that must be able to continue activities after the projects' involvement.

10.2.4. Community involvement and health education

Before it has been suggested that a RWS&S development in Anambra State should in the first place be village based and have put the improvement of the local water supply and sanitation situation in the perspective of an endogenous community development effort, that is supported by various forms of outside assistance. In an individual village a project of that nature includes a number of stages and "community development functions" that need to be properly fulfilled if the project is to be successful. Stages and community development functions can be combined into a matrix (see table 10.1) which each cell contains a description of actual project activities in the village concerned.

While in this matrix the names of the village project stages given on the horizontal axis speak for themselves, those of the functions require some explanation:

- Mobilization
  The main purpose here is to arouse people's interest in efforts to find a solution for (water supply and sanitation) problems in their own village, to motivate them to actively participate in this, and to encourage them to persevere in their efforts when the going gets rough.

  One of the important ingredients of this function is public health education, even though it must be realized that a village's initial interest in an improved water supply system may not be health connected at all.

- Organization
  During all stages of project initiation and execution, villagers and staff of supporting services need to be organized for particular activities: villagers may want to establish Village Health and Sanitation Committees, they may want to organize the contribution to funds for operation and maintenance in Pump User's Association, they can establish small committees of Pump Caretakers to look after facilities once these have been constructed, etc. Likewise the Ministry of Health can decide to organize staff, paraprofessionals, and villagers around Health Clinics and the ANSWC may organize teams of mechanics that help villages to maintain and repair their RWS&S equipment.

  The organization of people for crucial activities has often been used as a method to reinforce social relations and introduce an element of social cohesion in project implementation. In many agricultural development projects, this function has revolved around organizing small groups of people around an income generating activity. In that case members of such groups often received group loans for the purchase of essential items (agricultural inputs, materials for weaving and dyeing, materials to build irrigation wells, etc.), which also contributed to greater commitment. For the same reason a RWS&S project would be well advised to explore the possibilities of introducing income generating aspects as well.

- Training
  This function includes training of villagers as well as government and other agencies personnel. Part of the training may thus be teaching villagers how to service handpumps or other pieces of equipment or how to build latrines. However, the training may also refer to sessions in which members of Pump User Committees learn some elementary bookkeeping to properly register villagers' contributions to operation and maintenance of the facilities. Or to special courses for village level public health educators, like the paraprofessionals mentioned earlier.

- Technical Support
  A village and its various groups may need technical advice and support before, during and after construction of RWS&S facilities. The construction section of the LGA based project team will provide this support themselves or organize input from other agencies e.g. the ANSWC.

- Institutional Support
  Before and during construction activities, a village may require support to initiate plans and keep them going. Once facilities have been constructed and inaugurated, there is the sustainment, operation and maintenance routine that is to be established, in which initially a village community is likely to appreciate getting some assistance. Then, if technical problems arise, a village needs to put up a request with the LGA or private mechanics or contractors to help them out. A matter in which a village may probably also welcome a helping hand.

The institutional support function provides a protective umbrella over village communities that participate in the project, so as to provide them with some backup, advice, and perhaps concrete assistance when and as long as this is needed.

A project of the above nature can be realized by following a "policies down/plans up" approach that combines the following elements:

- in consultation with State and other authorities, the framework for the design, implementation and follow-up of village based RWS&S development projects, that stimulates villages (aided by the Project, the LGA's, the RPMCU, and possibly other agencies) to draw up and execute their own plans;

- once this policy framework has been established and, through the LGA's, made known to the villages, the project can assist villages to formulate plans for the improvement of the water supply and sanitation situation. Finalized plan are to be approved at the LGA level and once approval has been obtained, a village may proceed to the construction phase. At that stage the Project starts decreasing its involvement in the village while taking measures to maintain its institutional support function there for as long as this is needed;

- during the construction and post-construction operation and maintenance stages, the responsibility for assisting the village in realizing its plans shifts from the Project (of which the presence in the village is only temporary) to the LGA and State agencies.

In its daily activities, the project should leave ample room for training, guidance, and supervision of staff. This can be done by organizing the work of Community Mobilization Section along the lines of the Training & Visit System in Agricultural Extension developed for the World Bank by Benor and Harrison (1977).

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TABLE 10.1: Matrix of project stages and functions in a village level RWS&S project

	PROJECT INITIATION	PRE CONSTRUCTION ASSESSMENT AND DESIGN	CONSTRUCTION	POST CONSTRUCTION OPERATION AND MAINTENANCE
MOBILIZATION AND CONSOLI-DATION	Introduce project in village. Solicit village level cooperation. Draw up village application form.	Evaluate technical options with villagers. Draw up indicative plan for action, indicating technical actions and required local commitments. Discuss plan with villagers and decide on action.	Prepare for community involvement in the construction of village level facilities. Select sites and construct the facilities. Mobilize for operation and maintenance once construction has ended.	Set up payment structure and initiate revenue collection and financial management procedures. Initiate village reporting system on the basis of community self surveys and community based monitoring procedures. Continue health education and initiate support programme for local health para-professionals.
ORGANIZATION	Organize village elders for meetings. Select target groups for health education. Arrange general village meetings.	Set up local WS&S work group in village. Collect villagers for decision taking meetings. Formalize initial WS&S work group in VWA.	Organize village construction teams. Organize for board and lodging of non-village personnel.	Install committees responsible for revenue collection and safekeeping, as well as collection of consumer information. Set up pattern for yearly VWA meeting. Organize special target groups for health education purposes.
TRAINING	Conduct health education at village level. Inform village population of project aims. Explain project procedures and expected community involvement.	Provide technical information where necessary. Give demonstrations of technical options where possible, take delegations to places where such solutions can be found in operation. Discuss required local commitments and how they can be operationalized.	Train VWA for O&M and revenue collection. Train operators and pump caretaker. Train local artisan and private contractors. Execute supportive health education and O&M information programme.	Provide technical training for pump operators, personnel of private contractors, etc. Provide health education training for MoH staff to enable them to continue village based health education programmes.
TECHNICAL SUPPORT		Assessment of technical options. Assessment of costs involved and forms of community involvement required.	Provide skilled labour and equipment. Provide technical trainers and training routine. Arrange for supervision of construction activities.	Provide technical back-up for village level maintenance and for major repairs.
INSTITU-TIONAL SUPPORT	Arrange for contacts with State and LGA authorities, involve village in RWS&S and health improvement networks in Anambra State.	Liaise between village and LGA or private contractors. Register VWA formally with LGA. Ratify contract between village and LGA.	Liaise with LGA and State authorities for construction purposes. Liaise with Min. of Health officials for health education and training of village level cadre for health improvement. Liaise with private contractors.	Arrange for supply and distribution/sale of spare parts. Assist in local finance management and consumer complaints procedures. Assist in establishing procedures for processing monitoring data and those for decision making on the basis of monitoring results.
FINAL PRODUCT OF STAGE	Application by village.	Contract between VWA and project.	VWA ownership of completed facility.	Continuous supply of safe water improved health increased capacity self-help.

This is in essence a management system for agricultural extension or community development, that combines a strict planning of field visits by extension staff during four days in the week, with a series of staff sessions for training and consultations on the fifth. In this set-up, a Community Mobilization Section would be working in a number of selected villages that are to be visited with varying frequencies, but on fixed days on the basis of a weekly or fort-nightly pattern that leaves the fifth day of each week open for training.

After elaboration of the priority list of villages from the baseline survey and the 6 and 2 months plans as proposed before in the paragraph on organization the activities of the Community Mobilization Section basically consist of working out the details given in the matrix of table 10.1.

10.2.5. Construction

Construction is mentioned as a part of village level activities in table 10.1. However construction requires a number of preparatory activities that must be executed by the LGA or LGA based project staff:

1. Global determination of technical alternatives, sites and cost estimates for a given village.

On the basis of this information the community mobilization section can propose the alternatives to the beneficiaries and let them make the selection.

2. Detailed survey

3. Detailed design

4. Preparation of tender documents/ tenders

5. Execution or supervision of execution

6. Initiation of operation

10.2.6. Operation and maintenance

The basic idea for long term sustainability is to make the direct beneficiaries responsible for operation and maintenance. For this purpose it is important that:
- the beneficiaries feel themselves the owners of the systems;
- the installation is designed for operation and maintenance by non-professionals;
- operators get appropriate training and tools;
- there is a backup for more difficult maintenance operations;
- a spare part distribution network is set up.

The sense of ownership should be generated by a substantial contribution of the target group to initial investments. Further on recommendations will be made what kind of contributions should be asked of the villagers.

One of the goals of community mobilization should be the creation of village water associations (VWA) that bear the responsibility for operation and maintenance. The VWA can delegate tasks related to its responsibility to private persons or organizations, depending on the local conditions and the type of installation. In annex 10.5 the organizational setup is elaborated for the various technical options. The private sector should take over various tasks from the LGA's if possible.

In annex 10.6 recommendations are made how to assure the availability of spare parts.

10.2.7. Training

Generally speaking the key staff met in various organisations seemed to be well qualified and trained for their job. Training should therefore be aimed at:

- newly recruited staff
- existing staff that gets other or additional tasks
- operators and caretakers
- trainers of the beneficiaries (e.g. health educators)

From point of view of State and LGA budgets the number of staff to be recruited for RWS&S development should be minimal, so training of that group will be relatively minimal on the total budget for construction. Training cannot be easily quantified for the whole operation, so a precision will be presented in the action plan for the three selected LGA's.

10.3. ORGANIZATION

10.3.1. Introduction

The proposed activities require a permanent organization that gets support from a temporarily but at various levels operating project team. In the paragraphs below a permanent institutional setup is proposed and the organizational needs for the project team that gives the support.

For efficient use of funds it is proposed to organize village activities per LGA. In order to be able to attract foreign donors activities should be grouped into a limited number of years, proposed is 4. During this period not all population of an LGA can be served: 60% has been mentioned as a Federal policy. After this period the support staff will move to the next LGA to set up activities there.

The permanent LGA staff should then be capable to undertake community development and health education activities in the villages and help the villagers to construct appropriate facilities.

10.3.2. Institutional setup

The proposed institutional framework is based upon the following:

1. The villages are the focal point of all activities;
2. A project operates independently for one LGA; all activities in the LGA are planned, coordinated and executed by this project.
3. A at state level operating team plans, coordinates supports and supervises various LGA projects.

A. Village/Community Based Development

In principle, the way to provide a certain village or community with water supply and sanitation facilities consists of four different stages: initiation, decision making, realisation and operation. Each stage can be characterised by a set of key activities. In such an approach, the role of the project organisation will be facilitating the process in the communities and making resources available and coordinating resources and inputs from other organisations. It is not the intention that the project will more or less parachute facilities in communities.

The approach can be applied for both construction of new facilities and extension or rehabilitation of existing ones.

B. LGA Based Development

The activities at the LGA's will have a two objectives:

- sustainable and short term development of RWS&S in the villages;
- transfer of knowledge from the temporarily at the LGA based project staff to the permanent LGA staff, allowing the latter to organise construction of new facilities after completion of the project and support the communities with advice that have become owners of facilities created by the project.

Therefore the team that works for the project will be composed of staff that is permanently based at the LGA and staff that will be seconded to the LGA for the duration of the project.

C. At State Level Operating Primary Organisations:

State level RWS&S planning, monitoring and coordination unit (RPMCU)

At state level, one and only one agency is to be in charge in the overall sector programme control. Besides the already existing State Rural Development Implementation Authority, which is actually the policy board, an administrative agency within the civil administration and made up of professional civil servants is required. The activities of this professional agency comprise a.o. of:

- organize, coordinate and monitor LGA based activities
- keeping up-to-date overview of existing water supply facilities and schemes and their state (regardless which agency, community or organisation is responsible for that facility);
- collection of data and analysis of these in order to assess effectiveness of existing and future schemes;
- keeping up-to-date overview on on-going programmes and proposed programmes related to water supply and sanitation (in order to prevent overlaps or uncovered areas);
- policy preparations on rural development in general and water supply and sanitation in particular;
- coordination of other relevant state level governmental and non-governmental organisations;
- translation of federal policies and guidelines into measures in Anambra state;
- acquiring and monitoring of funds (either federal, state or foreign funds);
- daily administration and support for the Rural Development Implementation Authority (policy board on rural development, made up of all relevant commissioners, chairmen/principal executive of task forces and the (military) governor as the chairman).

The State Department for Rural Development is considered the most appropriate agency to fulfil this role. As of today, this agency already partly executes similar tasks, mainly concerning the federal programmes on rural development (DFRRI).

Policy body: State Rural Development Implementation Authority

The State Rural Development Implementation Authority, consisting of relevant commissioners, chairmen or principal executives of task forces and headed by the (military) governor, is considered to be an appropriate body for the political backup of rural development. Such a body can however only be effective in case this body avails full support of a professional administrative agency as mentioned above.

State level based project staff

Some temporary staff will have to be recruited for guidance and assistance of the permanent staff of the State level RWS&S planning, monitoring and coordination unit and for development of procedures, materials etc. to assist LGA based projects.

D. At State Level Operating Secondary Organisations:

Some state level organisations and agencies will via the RPMCU provide to the LGA projects expertise, manpower, information, materials etc., depending on the specific situation and stage of a project. Among these are the following organisations and agencies:

Rural Development Authority

For the implementation of works that are agreed for execution the Rural Development Authority (RDA) can play different roles such as:
- seconding staff to the LGA based projects;
- acting as an implementing agency;
- acting as a contractor that hires in its turn subcontractors.

It is not excluded that other capable agencies can play the same role. In this respect, e.g. the water supply section of the Agricultural Development Programme ADP may fit into the programmatic approach.

Ministry of Health

The Ministry of Health (MOH) will be mainly involved in health education. This activity is, in contrary to the construction of the facilities, an on-going activity of which only the contents can differ gradually according to the time, stage and needs. Health education must be part of the initiation stage and is to be continued after completion of the physical parts of the projects. Professional input from the Headquarters of MOH is desired for the design of educational programmes and preparation of materials. The actual execution of the programmes will be the responsibility of the LGA based staff (preferably) or zonal office based staff.

Anambra State Water Corporation
Besides operation and maintenance of technically more complex systems, the ANSWC can provide training for operators regardless who is to bear ultimate responsibility for the system and for the operation and maintenance. Further, the ANSWC can make her know-how and experience available for the programme as a whole.

Federal Department of Groundwater Resources
The state branch office of the Federal Department of Groundwater Resources can provide information on geological structures and availability and features of groundwater.

Anambra State River Basin Development Authority
This agency can provide information on the availability of surface water and measures, prescriptions, proposed and on-going activities etc. related to surface water management. Although the role is as now only assessed as small, the whole programme should be in contact with this agency.

E. Private Sector

The private sector should be involved in the programme as well:
- During the construction, contractors and suppliers will perform certain tasks, all to be controlled by the project.
- Depending on the chosen model, operation and maintenance can become the responsibility of the private sector. Either the ownership of facilities (or a part of it) can be transferred to the private sector or certain activities can be hired out to private enterprises. Some examples: privately operated standposts; maintenance contracts. A prerequisite will be proper arrangements in writing, between the involved parties. The ANSWC can act in some cases in a similar way

10.3.3. Required permanent staff

Permanent staff is necessary to keep developments going at State and at LGA levels. The number of staff required is estimated as follows:

at the RPMCU:

Data collection and processing staff:	2
Water supply and sanitation engineers	2
Economist	1
Community development expert	1
Demographer/ sociologist	1
Cartographer	1

at the LGA's

Community development inspector	1
Financial/ administrative staff (for training and guidance on bookkeeping, revenue collection, basic financial analysis)	2
Technical staff (for preliminary technical assessments, supervision during construction, backup and maintenance)	3
Health staff	3

10.3.4. Project staff

A Nigerian Project Manager	1
Eventually an expatriate counterpart	1
Technical staff: water supply/sanitation engineer	2
Data collection supervisor	1
Economist	1
Training materials developer/media Expert	0.25
Community development officers	2
RDA-liaisoning officer	1

and supportive staff.

The composition of the LGA based project team must depend on the specific conditions in the LGA. For an LGA where water points like handdug wells or shallow boreholes are most promising such a project team can consist of:

Project manager	1
Community mobilisation/health education officers	7
Technical officers/engineers (survey, design, training of staff on operation and maintenance)	2
Area coordinators	3
Draftsman	1
Supervisor	1
Financial/administrative officer (set up and assistance on financial analyses, revenue collection systems, bookkeeping, training)	1
Trainer (training coordination and administration, training of trainers)	1

and supportive staff.

Apart from this assistance by staff the activities at both State and LGA levels will need a logistic support: office and field equipment and vehicles.

10.4. FINANCING

This study aims not to indicate how funds can be found for the proposed activities. Funding can come from LGA, State or Federal Government budgets or from foreign donors, but as stated before it is essential that beneficiaries do a certain contribution towards capital investment. Most logic is to ask a contribution in labour and a payment for elements that have a medium time of life like handpumps. This way it will be more acceptable for the villagers to pay for its replacement after a number of years.

It is up to the State Government to find the necessary funds. The Plan of Action is a first tool in this process. The proposed RPMCU has a permanent task to do all the necessary to obtain new funds.

In chapter 6 the total number of facilities required to serve 60% of the rural population and the construction costs have been estimated at 27 million US$ for the year 2000. If the proposed activities are executed at a more realistic speed with the year 2005 as the horizon the number of rural people will have gone up by 13% (2.5%/year) so construction costs will be equally higher.

From the budgets made in the Plan of Action it is learnt that direct construction costs are only a small part of total project cost: 31%. This brings the total financial needs up to 95 million $ for the year 2000 horizon so 9.5 million $/year or 108 million $ for the year 2005 horizon so 7.2 million $/year, plus inflation.

10.5 PLANNING OF ACTIVITIES

The baseline studies will require half a year each but can overlap in different LGA's. This way about 3 LGA's can be covered in a year: a baseline survey in all LGA's would then last 8 years.

The capacity of the RPMCU will be one of the limiting factors for RWS&S development in Anambra State. Activities in approximately 6 LGA's at the time can be coordinated by the unit at the time. This means that an overall period of 15 years is required to achieve the objectives of the Strategic Plan.

The Plan of Action of volume 2 proposes activities in three LGA's plus support at State level activities. Once the approach has proven successful more similar plans must be formulated on the basis of the results of the baseline surveys. Then the number of LGA's with activities must be expanded from 3 to 6 at the time.

Planning of activities within an LGA strongly depends on the type and number of facilities desired. An overall execution time of 4 years can be used as a guideline.

In many of the LGA's the emphasis will be on handdug wells and shallow boreholes with handpumps. In case of handdug wells the execution capacity is limited by the community mobilization and well construction activities. In case of boreholes only the first is limiting the production capacity.

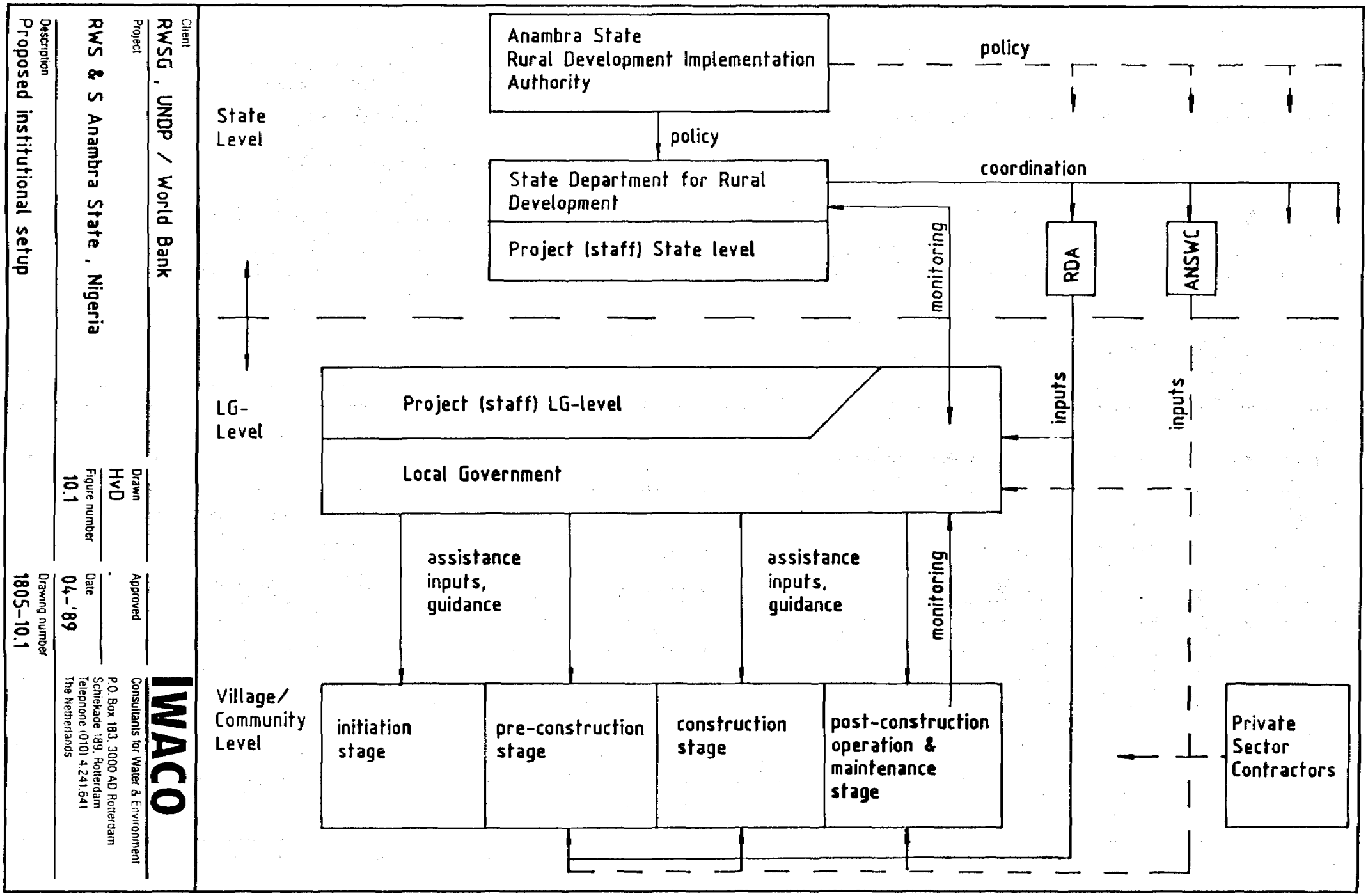
An indication of the possible timing of activities of a Community Mobilization Section in an LGA is:
- 4 weeks are taken for drawing up the priority listing for the LGA
- 4 weeks for introducing the project at the village level
- 12 weeks for pre- construction assessment and design
- 8 weeks for construction, flowing over into
- 24 weeks for guidance in post construction operation and maintenance.

Allocating 2 new villages per 2 weeks to each couple of Community Organizers of which there are three in the Community Mobilization Section during the first 8 weeks of project execution, would allow a Community Mobilization Section to cover the first 24 villages in its LGA after 58 weeks and the first 48 after 82 weeks, not providing for slack periods during the agricultural season. In that set-up, no Community Organizer would be responsible for more than 8 villages at any one moment in time and in most cases he or she would share this responsibility with a team mate. This allows for an average of one visit a week to each village, which should suffice.

This rhythm would be sufficient to equip about one hundred villages per year of a water supply facility.

For well construction a vast number of people is required to realize this same construction rhythm. A team of two artisans can construct up to 3 wells/ year so 100 wells per year requires 33 teams.

A life cycle of 4 years of activities within an LGA allows 3.5 years for construction, with a limited production at the beginning because people need to be trained. This way the maximum number of handdug wells or boreholes is approximately 250 during such a period.



Client
RWSG , UNDP / World Bank

Project
RWS & S Anambra State , Nigeria

Description
Proposed institutional setup

Drawn
HvD

Figure number
10.1

Approved

Date
04-'89

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Rainfall.

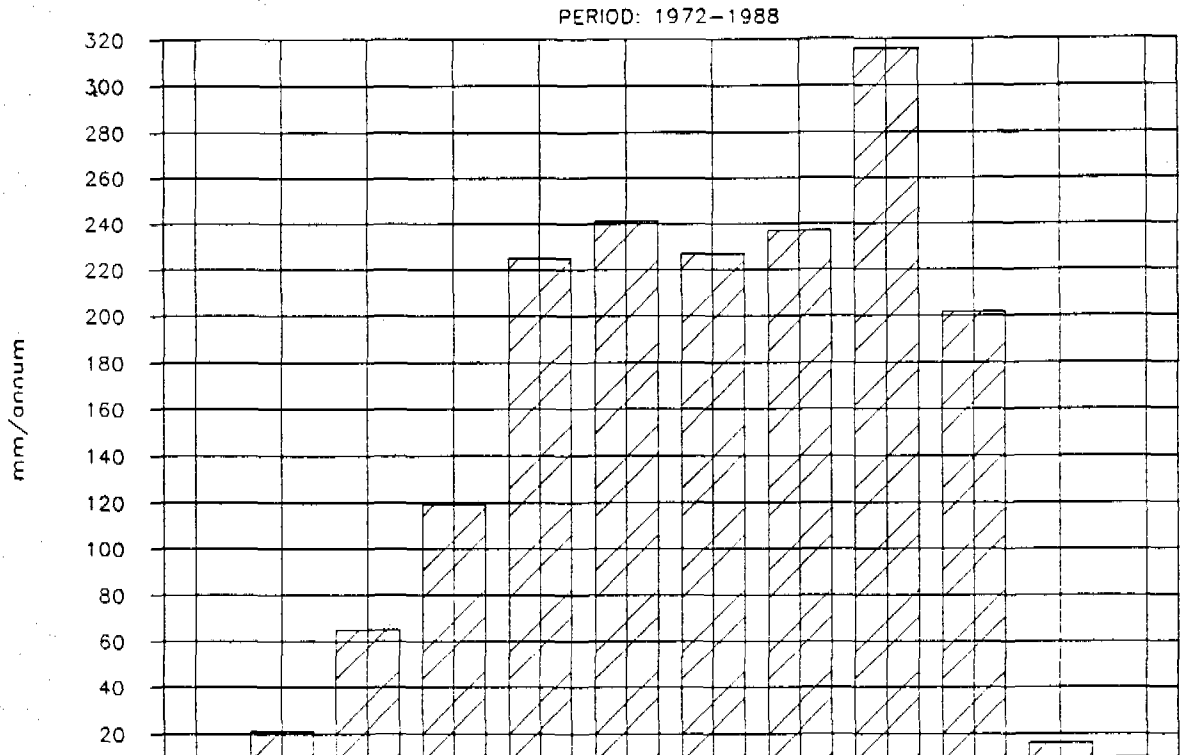
ANNEX 3.1:

MOTHLY AVERAGES OF 4 RAIN GAUGING STATIONS:

ENUGU:	1972-1988
IKWO:	1982-1987
NSUKKA:	1980-1988
ONITSHA:	1974-1988

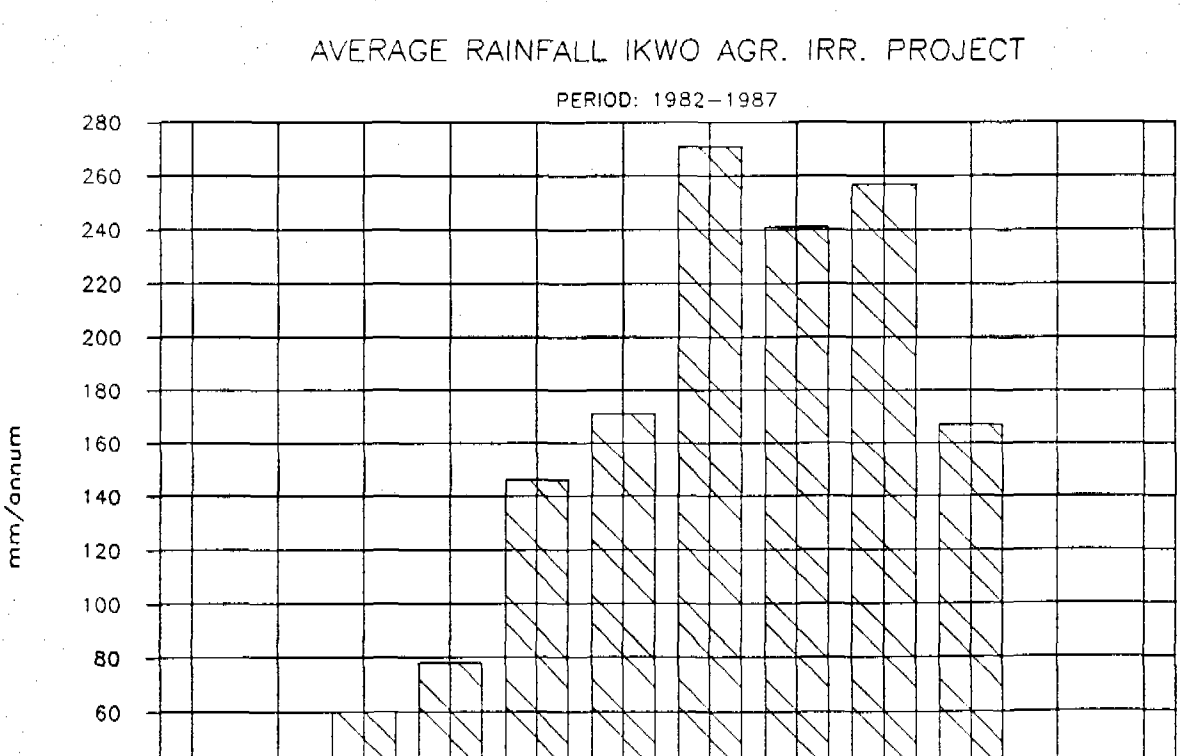
AVERAGE RAINFALL ENUGU

PERIOD: 1972–1988



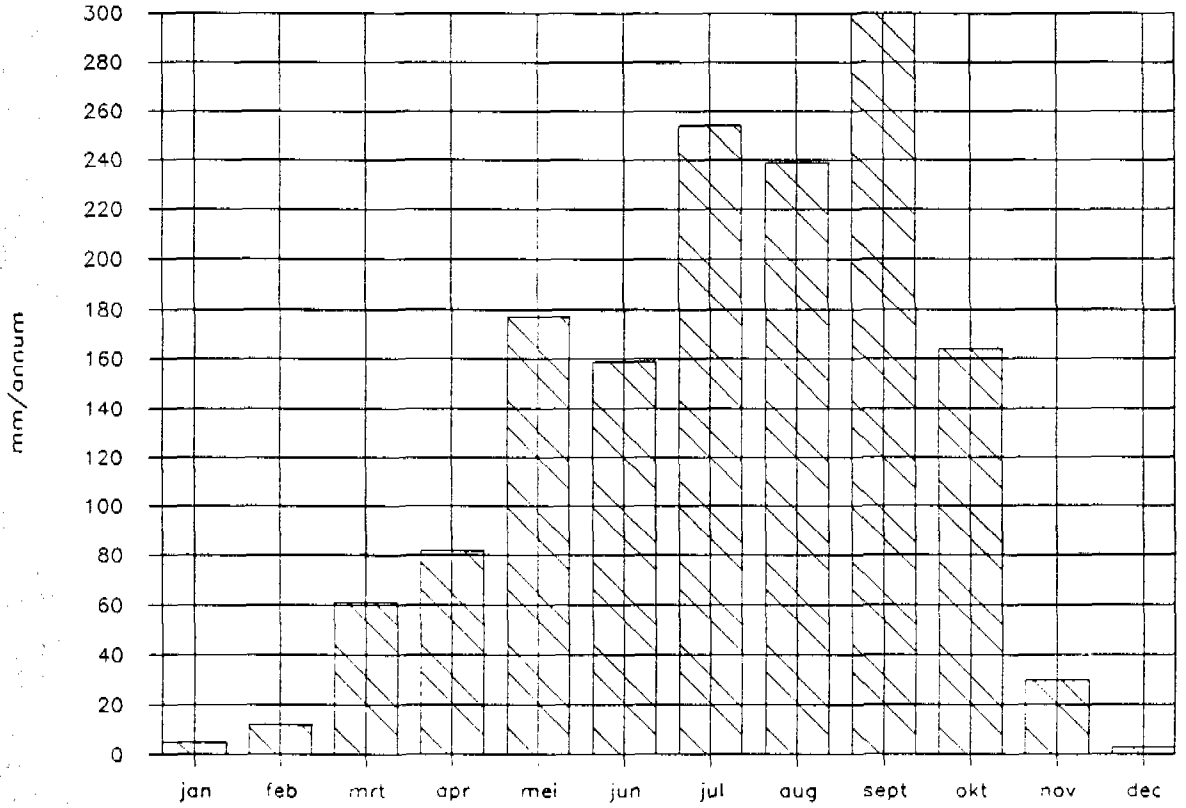
AVERAGE RAINFALL IKWO AGR. IRR. PROJECT

PERIOD: 1982–1987



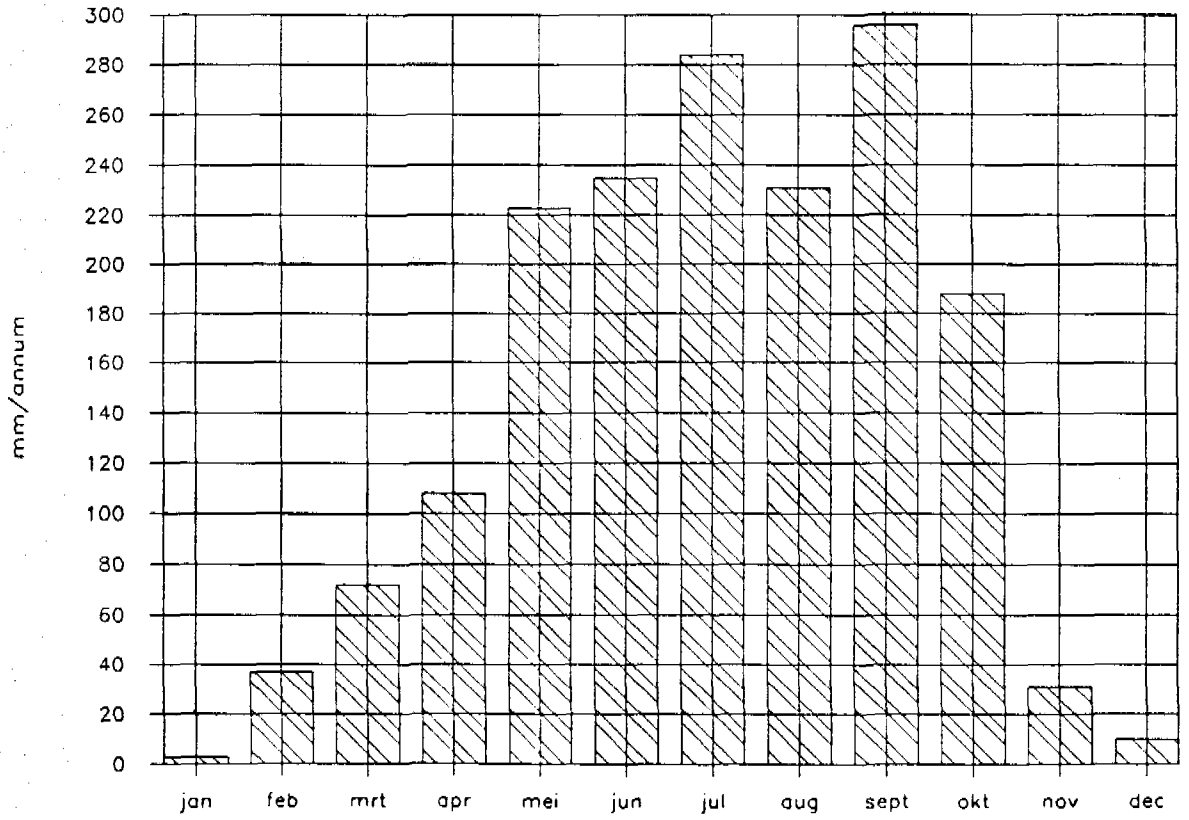
AVERAGE RAINFALL NSUKKA

PERIOD: 1980–1988



AVERAGE RAINFALL ONITSHA

PERIOD: 1974–1988



Hydrogeology of Anambra State.

ANNEX 3.2: HYDROGEOLOGY OF ANAMBRA STATE

A geological map of Anambra State is given at the end of this annex. A lithostratigraphic table that was established after the geologic maps of the Geologic Survey (1962) is equally presented. A geologic cross section and a lithologic map are included in chapter 5 of the main text.

Characteristic for the geological structure of Anambra State are a SW-NE anticlinal axe that goes over Abakaliki and a NS synclinal axe at the Western boundary of the State. On the anticlinal axes all the younger formations have been eroded off and the oldest Asu River Group (Cretaceous) is found at ground surface. Going from Abakaliki Westwards the formations at the surface become younger till the quaternary deposits of the Niger river. Most striking is the formation of the Lower Coal Measures that forms North-South directed escarpment that is very distinct throughout the State. Enugu was founded as a coal mine resort to exploit this formation so lays very close to the escarpment.

The older formations East of the escarpment are mainly shales, the younger formation West of the escarpment mainly sandstones. Relief is most distinct in most of the areas West of the escarpment.

Tahal (1988) distinguishes the following aquifers, aquitards and aquicludes:

QUOTE

1. AQUIFERS

a) Niger and Lower Cross River Alluvium

The alluvial terraces flanking the Niger River are widest in the wedge-shaped interfluve of the Niger and Anambra Rivers, and their thickness, certainly greater than 50 m in places, is not established. The alluvium is braided with old stream channels and oxbow lakes.

The same applies to the flood plains of Cross River near Obubra. For the purposes of groundwater exploration, the Niger and Cross River alluvium can be divided into unstable migratory alluvium in the stream channels, and stable, low terrace alluvium on the flanks of the flood plain.

The depths of boreholes may be up to 40 to 50 m, while the depth of the static water level varies from 2 to 8 m. In areas where alluvial terraces of the Niger and Cross rivers are accessible, the possibility of exploiting potable groundwater in sufficient quantities will be considered. Based on Tahal's findings, along the Benue River (Gongola State), sand and gravel

water-bearing horizons, replenished upstream by the Niger and the Cross rivers may be detected beneath the upper clay cover. It is also possible that water from this horizon may not be contaminated because of the water flows through the sand layers.

b) The Coastal Plain Aquifer

This is a very important regional aquifer in eastern Nigeria, which occupies a small triangular area in south-western Anambra, around Ihiala. The sediments of the Coastal Plain Group are lenticular, composed of loose sands. There is normally no lateral continuity of bedding, the sands are fine to coarse, including here and there gravel and some clay horizons. This aquifer overlies uncoformably the Bende Ameki aquifer. The aquifer is 50 to 60 m thick, the specific yields are 20 to 30 m^3/hour per 1 m of drawdown and the depth of the static water level is normally in the range of 30 to 50 m.

c) The Bende Ameki Group

The Bende Ameki Group discordantly underlies the Coastal Plain Sands and discordantly overlies the Imo Shales, and its sediments, which are characterized by lateral and vertical variations in lithology, dip at low angles (1 to 3 degrees) to the southwest.

The northwestern districts, in the Awka-Onitsha-Okwelle triangle, are dominated by a thick sandbody, the Nanka Sands, which is best developed in the Nanka-Nnobi area and thins to extinction to the southeast of Okwelle. The main body is a semi-consolidated sandstone with a few shale bands. The sandstone is in places extremely hard to drill and the samples are all strongly fractured, especially where they originate from deeper boreholes.

The depth of water level varies with the topography, from a few meters to more than 200 m (north of Idemilli River). The specific yields are 1 to 10 m^3/hour per 1 m of drawdown.

Many springs issue along the contact between the perched sand beds and the shales of the Bende Ameki. The base flow of the Nkissi and Idemilli rivers is fed by springs and seepage from this aquifer. The water is potable quality, containing in many places iron.

d) The Falsebedded Sandstones

The most important formation from the hydrogeological point of view is the Falsebedded Sandstone, composed of a body of sandstone some 450 m thick in the north and about 200 m in the southeast. The specific yields are similar to those of the coastal plain aquifer. A mean value of 5 m^3/hour per 1 m drawdown is valid in most parts of this aquifer.

The largest perennial springs of Enugu escarpment rise in this very fine sandstone of the Falsebedded formation. The depth of boreholes as well as the static water level vary according to the topography from tens of meters to more than 300 m.

2. AQUITARDS

a) Upper and Lower Coal Measures

They are about 60 to 90 m thick each, consisting of a rhythmic sequence of shales, siltstones, sandstones and jointed coal seams.

Near the Oji River the sandstone comprises 25% of the section. The sandstone horizons and lenses within the Upper and Lower Coal seams have only local importance as a groundwater resources and may be considered as aquitards.

b) The Awgu Sandstone

The Awgu Sandstone contains water, probably in joints and fissures rather than in pores. This is suggested by the issue of water from springs located along fissures, by the behaviour of the mud circulation and the rock during drilling, and by the cemented texture of the rock. The altitude of the water table is not established, but the aquifers are confined by shale layers away from the outcrop.

c) The Asu River
Some compact sandstone lenses interfingered within shales comprise this aquitards. This formation underwent tectonic activity and compaction, hence its permeability is secondary and most of the groundwater flows along fissures and faults.

3. AQUICLUDES

a) Imo Shale Group
b) Asata Shale Group
c) Eze Aku Shale Group

Most of these groups are composed of compact shales and siltstones.

UNQUOTE

CHRONO- LITHO- STRATIGRAPHIC TABLE

GEOLOGICAL UNIT NUMBER	PERIOD	EPOGUE	FORMATION	LITHOLOGY	GEOMORPHOLOGY
2	Cretaceous	Albian	Asu River Group	Shales and argillaceous sandstones with dolorite sills and dikes	Cross River Plain with dulations
3		Turonian-Cenonian	Eze Aku Shale Group	Shales and argillaceous sandstones with dolorite sills and dikes	Cross River Plain with dulations
4		Lower Senonian	Awgu Ndeaboh Shale Group	Shales and argillaceous sandstones	Cross River Plain with dulations
5		Upper Senonian	Asata Nkoporo Shale Group	Shales and argillaceous sandstones	Cross River Plain with dulations
6		Lower Maestichtian	Lower Coal Measures or Mamu Formation	Shales, siltstones, coalseams	Escarpment
7		Middle Maestichtian	False bedded sandstones or Ajali Sandstones	Sandstones	Plateau in North, Cuesta in South
8		Upper Maestichtian	Upper Coal Measures or Nsukka Formation	Shales, sandstones, coalseams	Minor cuesta, mesas
10	Tertiary	Lower Eocene/ Paleocene	Imo Shale Group	Shales	Lowland with ridges
11		Eocene	Bende Ameki Group	Sandstones, shales	Dissected plateau and ridge
12		Pleistocene Oligocene	Coastal Plains Sands or Benin Formation	Sandstones, sand, clay	Gently sloping plain
13	Quarternary	Holocene	Alluvium	Sand, silt, clay	Lowland

SOURCES:
Geologic Survey of Nigeria (1962)
Uma and Egboka (1988)
Gauff Ingenieure GmbH & Co (1988)
Tahal Consulting Engineers (1988)

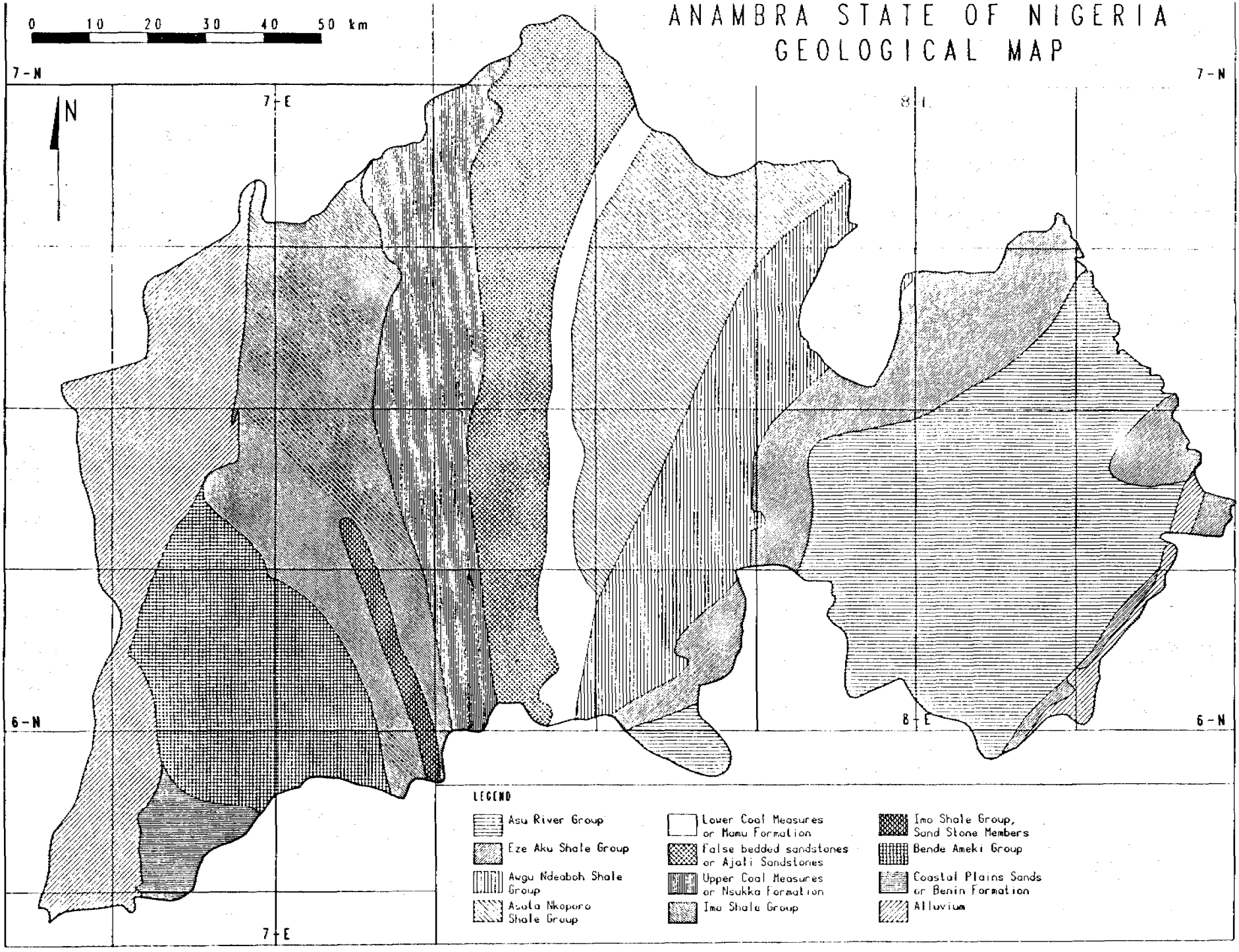


Figure 1 of annex 3.2

Population densities

ANNEX 4.1: POPULATION PER LGA

LGA name	Head quarters	Population 1990	Surface Area km²	Density 1990
Abakaliki	Abakaliki	462,224	2,211.9	209
Aguata	Aguata	486,969	798.8	610
Anambra	Otuocha	387,240	1,295.0	299
Awgu	Awgu	332,326	760.0	437
Awka	Awka	430,088	590.0	729
Enugu	Enugu	586,856	72.5	8,092
Ezeagu	Aguobu-Owa	214,616	613.8	350
Ezza	Onueke	271,786	747.7	363
Idemili	Ogidi	212,493	295.3	720
Igbo-Etiti	Ogbede	232,240	407.5	570
Igbo-Eze	Enugu-Ezike	307,980	466.2	661
Ihiala	Ihiala	266,800	321.2	831
Ikwo	Echara-Onuaboyi	170,598	373.8	456
Ishielu	Ezzamgbo	373,481	1,364.9	274
Isi-uzo	Ikem	272,957	1,261.3	216
Njikoka	Abagana	489,825	340.0	1,441
Nkanu	Agbani	301,718	1,497.0	202
Nnewi	Nnewi	354,235	272.7	1,299
Nsukka	Nsukka	346,819	407.5	851
Oji-River	Oji-River	119,095	379.6	314
Onitsha	Onitsha	673,282	492.1	1,368
Udi	Udi	210,158	973.8	216
Uzo-Uwani	Umulokpa	229,521	1,360.6	169
Total		7,733,307	17,303.2	447

State budget estimates for 1988.

ANNEX 4.2.a: REVENUES, RECEIPTS AND EXPENDITURES
ANAMBRA STATE 1988

	NAIRA	PART OF TOTAL REVENUES OR RECEIPTS
REVENUES		
RECURRENT REVENUES		
internal	139,821,020	18%
statutory share of federal account	444,802,000	56%
total recurrent revenues	584,623,020	74%
CAPITAL RECEIPTS		
internal loans	52,409,000	7%
external loans	118,000,000	15%
grants	7,500,000	1%
miscellaneous	30,600,000	4%
total capital receipts	208,509,000	26%
TOTAL REVENUES AND RECEIPTS	793,132,020	100%
EXPENDITURES		
RECURRENT EXPENDITURES		
personnel costs	203,960,790	26%
overhead costs	126,431,820	16%
consolidated revenue fund charges	91,008,980	11%
total	421,401,590	53%
CAPITAL EXPENDITURES (see detail in annex 4.2.b)	371,730,480	47%
GRAND TOTAL EXPENDITURES	793,132,070	100%

ANNEX 4.2.b: CAPITAL EXPENDITURES
ANAMBRA STATE 1988

	NAIRA	SUBTOTAL NAIRA	% OF TOTAL CAP. INVESTM.
economic sector:			
agriculture and rural development	25,270,010		7%
livestock and veterinary	200,010		0%
forestry	603,000		0%
fishery	70,000		0%
manufacturing and crafts	41,760,000		11%
rural electrification	12,000,000		3%
commerce, finance, cooperatives, supply	3,150,010		1%
land transport	29,588,090		8%
sub-total	112,641,120	112,641,120	30%
social services sector:			
education	67,950,610		18%
health	23,518,210		6%
information	2,650,000		1%
social development, youth, sports, culture	24,480,000		7%
sub-total	118,598,820	118,598,820	32%
regional/environmental development sector:			
water resources and supply	56,600,000		15%
environment, sewerage, drainage	2,037,500		1%
housing	710		0%
town and country planning	11,612,500		3%
community development	260,010		0%
sub-total	70,510,720	70,510,720	19%
administration sector:			
general administration	11,969,010		3%
public debt charges	58,010,810		16%
sub-total	69,979,820	69,979,820	19%
GRAND TOTAL		371,730,480	100%

Estimates (financial budgets) of selected Local Governments.

ANNEX 4.3: ESTIMATES (financial budgets) OF SELECTED LOCAL GOVERNMENTS

local government budget year	IGBO-EZE 1988		ANAMBRA LGA 1989		IKWO 1989	
	Naira	%	Naira	%	Naira	%
RECURRENT REVENUE						
federal	5,408,020	88	5,156,700	83	3,339,600	83
state	521,090	8	496,880	8	321,790	8
internal	247,840	4	589,650	9	380,620	9
total	6,176,950	100	6,243,230	100	4,042,010	100
OTHER RECEIPTS	0		25,000		38,060	
TOTAL RECEIPTS	6,176,950		6,268,230		4,080,070	
RECURRENT EXPEN-DITURES						
personnel costs	1,382,770	28	1,941,480	32	1,196,820	30
overhead costs	2,523,940	51	1,888,310	31	1,065,160	27
total recurrent exp.	3,906,710	79	3,829,790	63	2,261,980	57
CAPITAL EXPEN-DITURES	1,063,510	21	2,260,000	37	1,680,000	43
TOTAL EXPENDITURES	4,970,220	100	6,089,790	100	3,941,980	100
BUDGET SURPLUS	1,206,730		178,440		138,090	

Unit water prices at Igbo-Eze LGA.

ANNEX 5.1: PRESENT COST OF BOREHOLE WATER TO RURAL CONSUMERS IN IGBO-EZE LGA.

Type of Supply	Equivalent cost ₦/m^3
Bulk supply to tankers up to 5000 l is ₦5	1.00
Bulk supply to tankers up to 9500 l is ₦10	1.05
Bulk supply to tankers up to 12500 l is ₦15	1.20
Tanker supply to road site drum (200 l) is ₦3	15.00
Tanker supply to off road drum (200 l) is ₦6	30.00
To fill container at borehole tap (50 l) is ₦0.30	6.00
To fill container at borehole tap (25 l) is ₦0.20	8.00
To fill container at borehole tap (12 l) is ₦0.10	8.33

Note:These figures apply only to the dry season when there are no other alternative sources of water.

The selling of water in this fashion is only applicable to Igbo-Eze LGA of the three LGA's under study. It also occurs to a limited extent elsewhere in the State. In Nnewi Town for instance water is sold from tankers at 500 gallon for ₦20, equivalent to ₦8.8/m^3; 90 l containers for ₦10 equivalent to ₦11/m^3 and a standard bucket (12 l) of water for ₦0.5 or the equivalent of ₦41.66/m^3.

The urban domestic rate for piped water is ₦1.00/m^3 with a minimum of ₦6 per metered connection. An increase of 20% of this rate is proposed.

Existing institutional framework in the sector.

ANNEX 5.2: EXISTING INSTITUTIONAL FRAMEWORK IN THE SECTOR

Introduction

Various organisation and agencies are involved in the (rural) water supply and sanitation sector. As already described in chapter 4, organisations and responsibilities are rapidly changing. Therefore, items mentioned may be subject to change too.

Anambra State Water Corporation (ANSWC)

The Anambra State Water Corporation (ANSWC) has a Rural Water Supply Section. This Section operates water schemes in the more densely populated areas that will in the scope of this study be classified as semi-urban. The ANSWC is a parastatal organisation, administratively within the Cabinet Office and therefore indirectly reporting to the Military Governor. Only recently (at the end of budget year 1988) the ANSWC was transferred from the Ministry of Works to the Cabinet Office. The Commissioner of Special Duties is the political responsible commissioner.

The ANSWC is supervised by a Board of Directors, made up of five members which meets once a month. On daily basis, the ANSWC is managed by the General Manager, who has direct access to the Commissioner of Special Duties. The ANSWC is decentralized: besides a head office in Enugu five zonal offices are dealing with matter of daily operation and maintenance in their respective zones.

Although the ANSWC is generally considered as the main agency for water supply for whole Anambra State, in practice the ANSWC is only operating in highly populated urban and semi-urban areas. Also, until today only reticulated water supply schemes are operated by the ANSWC; apparently the ANSWC has indicated to have no objectives regarding the establishment of water schemes to low-density rural areas or the intention to be responsible for non-reticulated (thus point supply) water schemes.

Currently the ANSWC is stepping up some foreign assisted projects on the extension and upgrade of existing and construction of new urban and semi-urban systems (World Bank Greater Onitsha water supply project; African Development Bank).

One of the strengths of the ANSWC is that it is a rather stable, decentralized and professional organisation. The financial position however is troublesome: despite proposed increases of tariffs (20 %) for its urban areas, the ability to pay back loans and interests is not present. Also, because of the high inflation and currency instability and lacking

liquidity, operations and maintenance is seriously threatened due to increases of cost of chemicals (60 % increase) and spare parts.

Considering the size and scope of the new projects of the ANSWC and the financial burden, together with policies and attitudes towards rural water supply, the capacity of the ANSWC to embark on a rural water supply programme as intended in this document is very limited.

There are 46 existing water schemes serving 69 communities in 17 of the 23 LGA's in Anambra State which come under the jurisdiction of the Anambra State Water Corporation (ANSWC). Four of them are surface water schemes and the rest borehole schemes. Generally two boreholes are drilled per scheme of which one is fully equipped and in service. Boreholes vary from about 75 m to 210 m in depth and 200 mm to 300 mm in casing diameter. Boreholes are fitted with diesel generator operated submersible pumps which feed into elevated or ground level water tanks normally 182 m^3 - 682 m^3 (40,000 - 150,000 gal.) capacity from whence supply is made by distribution network. In about seven schemes the water is fed into small elevated water tanks of 23 m^3 - 46 m^3 (5000 - 10,000 gal.) capacity which feed standpipes around one location. Each borehole scheme was originally designed to serve populations of between 10,000 and 40,000. The surface schemes are in general semi regional with long pipe works and serve wider areas.

On average each of the schemes are approximately 20 years old and were designed to cover approximately 70% of each of the served community's population. The original designed population coverage of approximately 600,000 has now more than doubled to 1,358,000 and has a present theoretical water demand, assuming the minimum of 20 l/c/d or 27,000 m^3/day. However no borehole scheme has been enlarged or extended to take into account the extra demand. Aging equipment, inability to buy spare parts, lack of maintenance, leakages caused by either poor operation or poor initial installation due to inadequate supervision all contribute together with inadequately trained staff to ANSWC water supply schemes producing in 1983 (the latest available data by ANSWC, see table at the end of this annex) a supply of only 5,180 m^3/day, or 19% of the demand. There is no evidence to show that the production figure has increased since 1983 and considering the present economic situation it is highly probable that this figure has in fact decreased.

Lack of or conflicting current basic data makes it impossible at present to give a more accurate picture of the situation. It can be stated however that all the ANSWC rural water supply schemes require either complete replacement, renovation or extension in order to satisfy the present demand.

State Department for Rural Development (DRD)

DRD is the planning and (mainly) monitoring body for all rural development activities, which include: water supply, roads, electrification, housing, agriculture and social mobilization. The Department for Rural Development is a State body which is included in the Office to the Military Governor and is also the State counterpart for DFRRI programmes (federally funded programmes to be executed in each state). Previously, DRD was part of the Ministry of Local Government, but in order to become more effective, it was put in the Office to the Military Governor. The DRD is supervised by the State Rural Development Implementation Authority; the Governor is chairman of this board, members are all relevant commissioners and the chairmen of the respective task forces.

It does not execute programmes itself: this is done by implementing agencies by the task forces such as Rural Development Authority and the Agriculture Development Project.

Despite the fact that DRD is generally recognized as a main actor in the sector, the executive power is still too few to get grip on all relevant activities and agencies. A strength of DRD is its recognition of the importance of social mobilization and the positive attitude towards it.

Rural Development Authority (RDA)

The RDA is one of the tasks forces within the Office to the Military Governor. The RDA was founded in 1986 as a result of a merge of the Task Force for Rural Water Supply and the Task Force for Rural Roads. The RDA is the implementation agency for rural water supply and sanitation. Within an available budget, RDA can make up its own priorities and ask for approval from the Governor.

Agriculture Development Project (ADP)

ADP is a state government controlled operation, nowadays financed for about 66 % by World Bank, 20 % by federal funds and 14 % by state funds. Although mainly involved in agricultural subjects, to some extend ADP is or was involved in construction of rural roads and water supply facilities. The water section of its Engineering Support Sub-programme was in the past involved in improving some small scale water supply facilities and is willing to take up this responsibility in the future again. Some expertise on small scheme water supply and sanitation is present but as yet there are no on-going programmes.

Anambra State Environmental Sanitation Authority (ASESA)

The ASESA is one of the parastatals controlled by the Anambra State Government. Until today, it is mainly involved in garbage collection and disposal and operates public toilet facilities in urban areas. ASESA does not execute any activities in (low-density) rural areas.

Department for Local Government

Previously, the Department for Local Government was called the Ministry of Local Government. In that period, some activities on rural development and water supply were within the responsibilities of the ministry. As recently the ministry was transferred and became a department in the Office to the Military Governor, the role of the department is diminishing. The political responsibility is within the portfolio of the Commissioner for Special Duties. For the future, seen in the light of the new constitution and the strengthening of the autonomy of the local governments, the Department will mainly be involved in issuing guidelines to and audits of the local governments regarding their budgets. No responsibilities regarding the contents of (policies on) rural development, water supply and sanitation can be foreseen.

Local Governments

Although statutory the local governments still have the possibility to bear responsibilities on water supply, the actual involvement is virtually zero for most of the local governments. For semi-urban and urban areas, responsibility for water supply is nearly completely in hands of the ANSWC or privately operated.

The local governments are seen as the responsible organisations for sanitation. Most local governments are actually actively involved in it, either directly or through staff seconded at the LGA, mainly in health education and garbage collection and cleaning of public places. At LGA level three different offices are involved in health education and health related activities:

1. Primary Health Care Office: in each LGA the MOH has posted PHC staff responsible for its PHC programme;
2. LGA Environment Sanitation (ES) Office: each LGA is solely responsible for Environmental Sanitation in its area. Local Government Areas employ their own staff for this office;
3. Health Education Zonal Office: each LGA forms part of a zone in which a rural HE office operates. The staff is MOH employed.

In practice the PHC staff is mainly health center based, its activities predominantly curative but also preventive in character. Presently the Health Education zonal offices rarely operate in the LGA's outside the one the office are situated in. The ES staff effectively are the only ones working in the field of rural sanitation and community health education although seriously limited by lack of transport.

Apart from these three implementing offices, each LGA has a Supervisory Councillor for Health and/or a Supervisory Committee for Health who bear the political responsibility for health activities at the LGA level.

The outcomes in terms of construction of facilities for collection and treatment of human excreta is still low. In some urban towns sanitation partly became the responsibility of the ASESA.

Some projects on rural water supply in the past seem to have bypassed Local Governments rather than involve these in planning, operation or maintenance. It must however be admitted that regarding water supply and -to a lesser degree- sanitation the available manpower and expertise within the local governments is virtually absent.

On other matters of rural development, especially construction of roads and electrification, local governments do play a role in planning and execution. One of the strengths of the local governments is the policy regarding use of resources within the communities. LGA-based community development officers do play a key role in this matter. However, the available manpower is usually only one officer per local government; some Local Governments even don't have a community development officer. It should be noticed that community development officers in some cases have a dual role: besides the duties to act as a facilitator for social mobilisation within communities they also supervise activities of the community and provide some intelligence services to the governmental authorities.

Department for Food, Roads and Rural Infrastructure (DFRRI)

The Federal Department for Food, Roads and Rural Infrastructure provided funds for each state of the Federation to execute a programme. Based on a federal instruction, each state had to form its own DFRRI, which was to report to the Governor. For Anambra State, this counterpart organisation became the Department for Rural Development (DRD).

DFRRI funds were used for the execution of the 250 communities programme, which was executed by the Task Force on Rural Water Supply, an activity that was passed later on to the RDA.

Anambra State Ministry of Health (MOH)

The State Ministry of Health has activities that could be important for rural water supply and sanitation, especially the health education.

The Ministry of Health is actually involved in two RWS&S projects:
- UNICEF assisted WATSAN project.
- the Japanese funded borehole project.
Both projects are in general being seen as emergency programmes for eradication of the Guinea worm in the East of the State.

The MOH has six departments (see figure at the end of this annex) of which the Department of Public Health is of importance to future Water and Sanitation projects.

The Public Health Department is divided into six divisions. At first sight the Divisions of Primary Health Care (PHC), of Health Education and Environmental Services suggest to be the proper offices to be or get involved with water supply and Sanitation.

The PHC division is responsible for the implementation of the Primary Health Care Programme of the State. Activities involved are Expended Programme on Immunization (EPI), Maternal and Child Health Care, Leprosy Programme, among others. PHC is State level planned and coordinated but is actually operated at LGA-level through Health Centres and LGA-posted staff. PHC includes health education but mainly clinic based health education. Apart from health education and immunization PHC is rather curative than preventive in character.

The Health Education Division is as its name implies responsible for Health Education. The division has at State level several sections which support the education work being executed at the workfloor:
1. Graphic Art Section ;
2. Film Projection Section;
3. Research and Library Services;
4. Material and Child Health;
5. Communicable and non-communicable Diseases;
6. Committee on Mobilization and Educated Aspects;
7. Administrative Section.

As opposed to the PHC Division, Health Education works through zonal instead of LGA offices. The zonal offices are in: Onitsha, Oji River, Nsukka, Abakaliki and Awka. Of these the latter three were opened recently in 1988, whereas the former two have been in existence for a longer period of time.

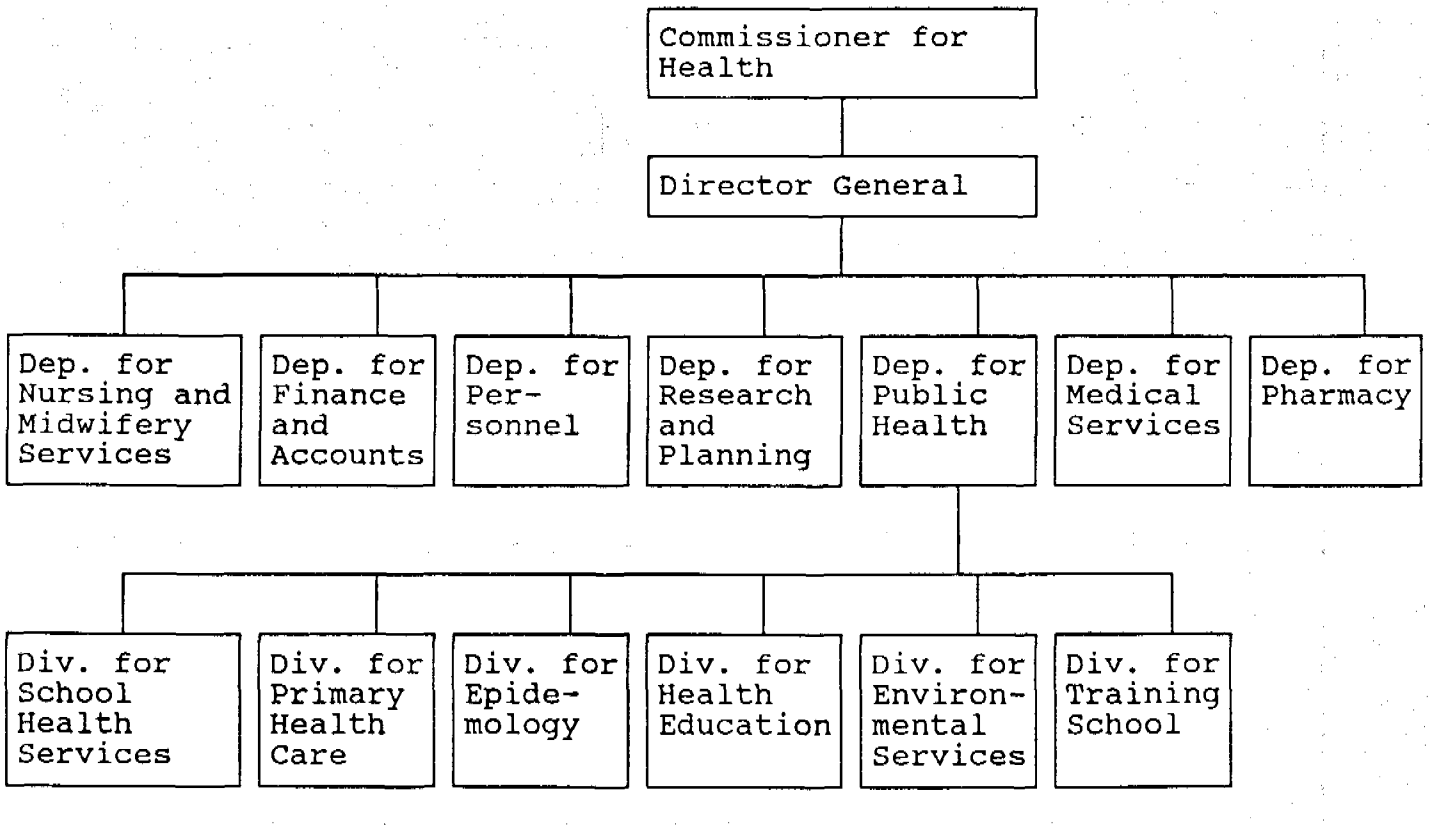
Each of the offices has a responsibility in health education towards all LGA in its zone. The Health Education offices have the following functions:
1. community mobilization (e.g. for EPI);

2. identification of health problems at community level;
3. identification of solutions for health problems:
   - awareness creation;
   - health education;
   - prevention.
4. conducting public health workshops for LGA staff and community heads;
5. school health education;
6. health education on:
   - nutrition;
   - family planning;
   - maternal and child health;
7. serve as a link between government, LGA and the communities in health matters.

The Division of Environmental Health Services contributes mainly to the Anambra State Environmental Sanitation Authority (ASESA). ASESA concentrates on refuse collection and disposal in five towns of the State (Enugu, Onitsha, Abakaliki, Awka and Nsukka) but to a lesser extent also engages itself in human waste disposal in these urban centres.

In short the State Ministry of Health presently is involved in urban sanitation but not in rural sanitation and neither in urban nor rural water supply.

RELEVANT PART OF THE ORGANIGRAMME OF THE ANAMBRA STATE MINISTRY OF HEALTH



Ongoing and proposed sector projects.

ANNEX 5.3. ONGOING AND PROPOSED SECTOR PROJECTS

a. Anambra State Water Corporation

The ANSWC has a section for rural water supply, that aims to serve the population in the largest communities, that are in the scope of this study classified as semi-urban. Existing schemes are indicated on the map presented in this annex.

By far the most important ongoing Sector project coming under the jurisdiction of the Anambra State Water Corporation (ANSWC) in the World Bank funded Greater Onitsha Water Scheme, which is partially completed. This however is a totally urban water supply scheme and therefore does not come under the terms of reference of this particular study. However due to the current economic situation there is a surplus in the World Bank loan for this project which is now to be used to finance the Detailed Study of the Anambra State Sub Project of the Multi-State Water Project. Technical proposals have been submitted by selected consultants to the ANSWC and final selection of consultant is at present being carried out. In earlier Nationwide Water Supply and Sanitation rehabilitation Study has strongly recommended a further but more in depth study of the rehabilitation needs of all the existing water supply schemes because of the lack of existing data. At that time no funds were available to proceed with this. However because of the current situation with the World Bank loan this recommendation will now be implemented as part of the Multi State Water Project.

Anambra State has included as part of its request to the African Development Bank (ADB) for a loan to fund a large infra-structural development programme a proposal from ANSWC seeking funds for 208 Rural Water Supply Schemes throughout the State. The location of these 208 communities is equally indicated on the map of this annex. A decision has yet to be taken by ADB on whether or not to fund this very ambitions proposal in its entirety. Certainly careful consideration must be made of the associated necessary operation as maintenance requirements especially in the light of the current state of the operation and maintenance of the 46 existing semi urban and rural water supply schemes in the state (see Annex 5.4). The ANSWC has carefully selected each proposed scheme on a needs priority basis and it must be assumed that even if ADB are unable to fund all the schemes additional funding will be sought from other sources to complete the proposal.

b. National Borehole Programme

The National Borehole Programme comes under the jurisdiction of the Federal Department of Water Resources. In Anambra State it is responsible for 52 schemes of which only 3 are commissioned and a further 3 are completed and awaiting commissioning.

Technical details and design parameters needed for these schemes were not available and therefore the theoretical population coverage is not known. It is assumed that each scheme should supply a population of up to 12,000. The outstanding work to be completed is still considerable and includes the following:

37 pumps to be installed;
12 elevated tanks to be completed;
39 generators to be installed;
14 generator houses to be completed.

It is not known if any of the above has been purchased or ordered and the status of the accompanied reticulation systems is also not known. It is unclear at present who is taking responsibility of the schemes once they have been commissioned and how and to whom revenue will be generated and accounted.

c. **The Rural Development Authority**

As the State implementing arm of the Directorate of Foods, Roads and Rural Infrastructure (DFRRI) the Rural Development Authority (RDA) was formed in November 1987 as a result of the disbandment of the State Task Force on Rural Water Supply. Since its formation it has implemented the construction of 13 borehole water schemes none of which have yet been completed. In general terms each of the schemes is the same, comprising of either a 250 mm or 300 mm diameter borehole fitted with a diesel generator operated submersible pump which feeds into an elevated 227 m3 (50,000 gal.) capacity tank from whence supply is made by 1 km of distribution to which stand pipes are fitted. The designed population coverage is not known.

No decision has yet been made as to who has the responsibility of the completed schemes. At present the RDA has a small mobile maintenance unit which would be incapable of servicing all of these schemes.

The RDA has inherited the responsibility of completing the 250 communities programme funded by DFRRI and initially implemented by the Task Force on Rural Water Supply. To date 144 boreholes have been completed and fitted with handpumps however the completion of the remaining 106 boreholes is uncertain due to limitation of funds.

The funding policies of the RDA water schemes vary but basically are as follows:

With the deep borehole systems the community must raise 25% of the estimated capital cost prior to construction commencing. On completion of the project the community is required to fund a further 15% and the Federal Government through DFFRI will then funds the remaining 60%;

with the shallow borehole programme each community where a borehole had been located was required to contribute ₦ 3000 towards its cost, this was the equivalent of approximately 10%.

d. The Japanese funded borehole programme

The Japanese International Cooperation Agency (JICA) has agreed to execute a project for the construction of 150 boreholes in LGA's of Aguata, Ikwo and Ezza, in order to combat the Guinea worm disease. The project will be executed by Japanese experts and contractors under the responsibility of the Ministry of Health. No activities in the field of community participation have been formalized so far, nor has any sanitation component.

e. UNICEF assisted Rural Water Supply and Sanitation Programme

This programme aims to create 300 boreholes with handpumps and the construction of VIP latrines in areas that suffer from Guinea Worm problems i.e. the East of the State. It just recently started in Anambra State but its approach is based upon experiences in other states, and is very close to the ideas of the mission for projects to be set up in the framework of this strategic plan. For this reason a more elaborated analysis community mobilization / health education aspects of the project is given hereafter.

The programme commenced in Ishielu LGA and at the beginning of February 1989 approximately 24 boreholes were completed and equipping them with handpumps was in progress. Drilling has yet to commence in Abakaliki LGA, where the sanitation component has already started.

<u>Community mobilization and health education aspects of the UNICEF assisted WATSAN project</u>

Within the WATSAN set-up two units have responsibilities in communication of the project with others:

1. the Community Mobilization / Health Education Unit (CMHE) and
2. the Project Support Communication Unit (PSC).

The PSC Unit is responsible for project Public Relations in general and for production of Audio-Visual training materials to be used for village level education. The CMHE Unit communicates with the target groups of the project and is responsible for:

1. awareness creation of target population;
2. mobilization of target population;
3. formation and training of health and water committees at village, community and LGA level;

4. health education of target population;
5. training of Village Based Workers;
6. evaluation and monitoring.

The PSC Unit consists of a PR officer, a photographer and a graphic artist. At that time the Unit did not yet have at its disposal the materials and equipment necessary to produce training materials and aids. The CMHE Unit has five staff members, three mobilizers and two health educators, among which two are females. One vehicle is available for the complete unit, with which the staff needs to cover both ISHIELU and ABAKALIKI LGA. Presently the unit does not yet have any teaching materials to work with.

The schedule of intervention, the community involvement expected and the role of the mobilization unit is explained in nine steps:

At LGA level

1. The first activity is to inform LGA authorities, politicians and community representatives about the selection of the area and the working methods of the project. Both Units have a role to play in this.

2. A so-called "core-group" is to be formed and trained at LGA level. A fair proportion of the work to be undertaken by the project is to be executed by LGA-staff. The LGA authorities themselves are expected to form a so-called "core-group" out of the staff already working in the LGA. The WATSAN projects advises to select health officers, health councillors, community development staff, carpenters, masons, etc. During implementation of the project these core-group members are expected to work hand in hand with project staff. After project termination the core-group is responsible for follow-up. The core-group is briefed and trained by WATSAN.

At Community level

3. After project authorities decided on which communities will be served by the project, the mobilization unit accompanied by core-group members, inform the Traditional Rulers and Ruling council of each community about the project. One community is operated in at a time. WATSAN decides on the communities, to avoid problems with local politics.

At Village level

4. The following step is for the mobilization unit to visit the villages and call for a general meeting in which the inhabitants are explained about (i) the project in general and (ii) the contributions expected from them.

5. **In subsequent meetings:**

   a. the villagers have to elect a Village Steering Committee. This Committee is to be responsible for the smooth execution of the project at the village. It is explained that the project is very important for women and children and that therefore the Committee should contain 1 (Ishielu) or 2 (Abakaliki) women, among a total of four members.

   b. the villagers have to select 2 Village Based Workers, one man and one women, from amongst their own. The VBW are expected to be responsible for health and sanitation matters and education in the village.

At Community level

6. At community level an Autonomous Steering Committee is to be formed out of 2 representatives from each Village Steering Committee. This Committee is responsible for smooth execution of the project in the community and for supervision of the VBW after the project is completed in the community.

At Village level

7. During and after the abovementioned phases the mobilization unit at village level continuously motivates and assists people in the construction of VIP latrines. For each borehole the WATSAN project expects the village to erect 10 VIP latrines under guidance of the project but at the expense of the villagers.

8. Throughout the complete process health education lessons are conducted. Women in particular are the target group for education. Education is primarily important, according to the WATSAN staff, to convince people of the need for VIP latrines.

9. As soon as a number of VBW are selected by the villages, the VBW are trained. The total training takes 8 weeks, three of which the trainees come to a central point to learn about health and the subsequent 5 weeks in which VBW perform the duties assigned to them in the village and are monitored closely.

The qualified VBW are expected to do 3-5 house visits per day, after completing their normal work in the fields (!). The activities 7, 8 and 9 are the sole responsibility of the community mobilization and health education unit.

It is WATSAN's policy to install and commission water supply systems (boreholes equipped with handpumps) only after the village has constructed the required 10 VIP

latrines. After handing over of the pumps and training of VBW, WATSAN leaves the village and community. The LGA core-group is expected to follow up on (i) monitoring of VBW-performance, (ii) operation and maintenance of water supply facilities and (iii) construction of additional VIP latrines.

Community involvement consists of the following:

- decision-making in village and community steering committee election;
- decision-making in VBW selection per village;
- participation in health-education; passive participation by specific target groups and active participation by VBW;
- provision of building-materials for, and actual construction of, 10 VIP latrines;
- provision of building-materials for slab construction of the handpumps;
- on-going health-education after project termination by VBW;
- on-going supervision of health related activities in the community by the steering committee.

For their contributions the community receives the following in return:

- community mobilization;
- health education;
- training of steering committees and VBW;
- supervision by skilled labour in VIP latrine construction;
- construction of a borehole fitted with a handpump;
- ongoing maintenance of the water supply system by a LGA maintenance crew.

It should be noted that WATSAN decides on the communities to be served. Communities do not have decision-making power whether a particular community will or will not participate in the project. Moreover once WATSAN has selected a community the community has to contribute and go along according to the plan. Participation nor contributions are negotiable.

Since the WATSAN project in Anambra State has been in operation since late 1988 only, experiences are mainly in the first phase of village intervention. Until sofar the mobilization unit has the following experiences:

<u>Village level</u>

- the rural population does not regard sanitation as a priority problem, the present design of VIP latrines asks for a large capital investment and the design does not fit rural circumstances (people live in mud houses with thatched roofs whereas the VIP latrine should have concrete blocks and a sink-sheet roofing);

- "selling" expensive VIP latrines to people who do not see a need for them is the most difficult problem for the unit in the villages. The obligation to build latrines can even lead to an adverse effect regarding water supply: people loose interest in the future provision of handpumps, do not feel the project is "self-help" and do not show initiative towards water supply projects;

- boreholes have been drilled in Ishielu LGA notwithstanding the fact that VIP latrines had not been constructed. People feel water is coming and refuse to construct latrines;

- it is difficult to assemble people in the village during the day, because of their farming activities;

- local politics frequently obstruct borehole siting.

LGA level

- the core-group input and performance is essential for project success. Several problems hamper smooth execution of the project at this level:

  * political :members of the core-group are seeking the interest of their own communities, if the community is not part of the programma they rather obstruct than assist;
  * logistical :core-group members do not have transport materials or equipment at their disposal;
  * staff input :insufficient LGA staff is available to undertake this additional task. Also the quality of the input is poor, staff is not motivated because they do not receive extra support and incentive.

Agency level

- mobility, lack of staff and lack of education materials are the problems the unit faces at the agency level.

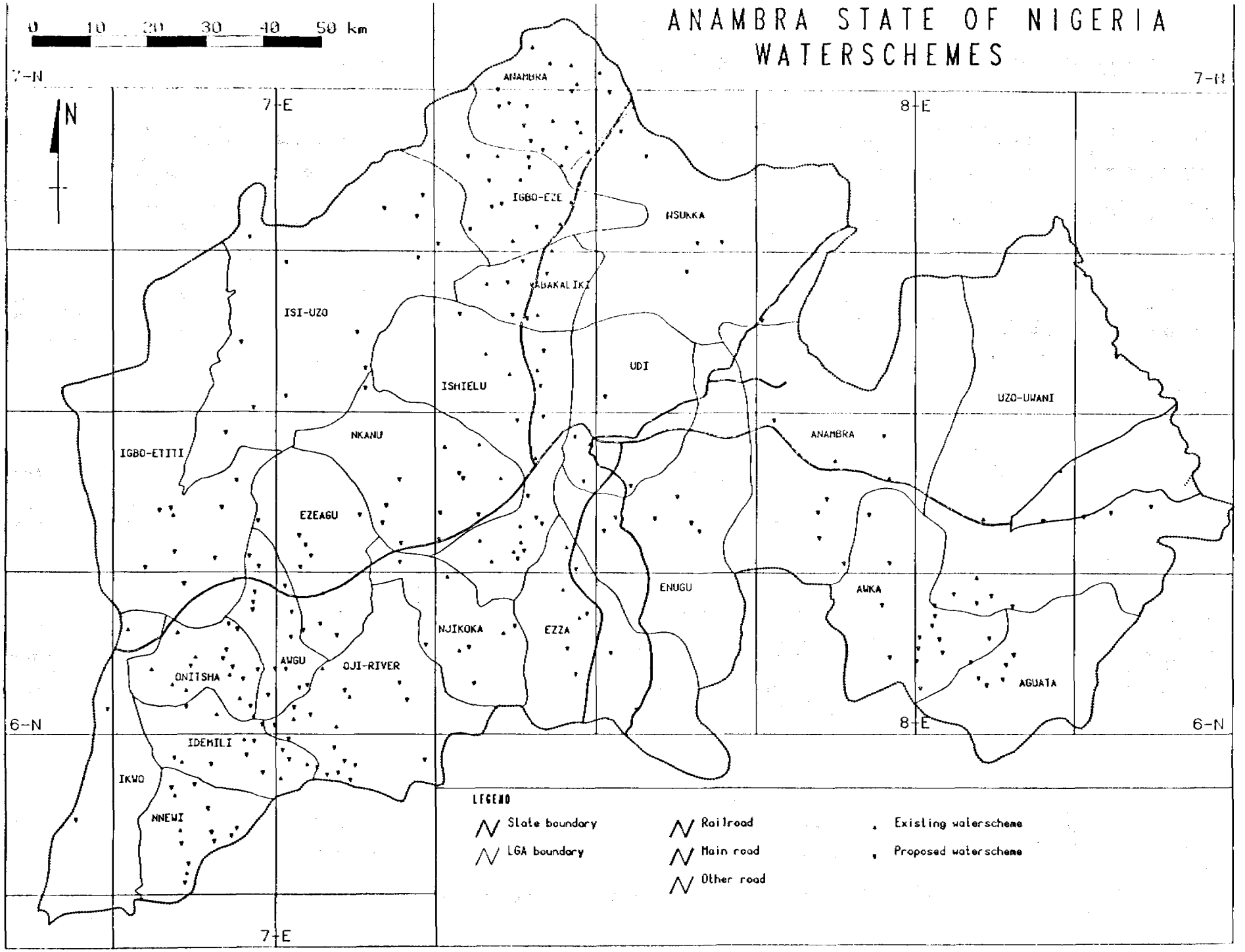


Figure 1 of annex 5.3

Algorithm for quantification of target group.

ANNEX 8.1: Algorithm for quantification of target group

For each LGA it has been determined what percentage of its territory is underlain by each of the five hydrogeological zones (see table of the next page, columns 2 through 6). The number of people that already benefit from existing urban schemes has been determined per LGA, as well as the people that will benefit from existing and planned semi-urban schemes. Those quantities are subtracted from the 1990 projections of population thus giving the rural population to be served. In order to obtain the size of the target group of the year 2000 a continuous population growth rate of 2,5%/year has been taken (rightmost column of table 6.2 in the main text). An equal distribution of this population of the LGA has been supposed. The proportion over the LGA's that lies in each of the five hydrogeological zones and the rural population equally spread over the LGA permits to determine the rural population number per hydrogeological zone (see table on the next page, column 7 through 11).

Next step was to determine the most appropriate technical solutions for each of the 5 hydrogeological zones, together with their capacity based on a 20 liter/cap/day consumption. Furthermore it has been estimated what percentage of the rural population can be served by each type of scheme. Referring to the national policy on water supply and sanitation for rural communities (Okeke, 1988) it has been supposed that 60% of the year 2000 rural population has to be served.

The five tables hereafter give a breakdown of the total number of schemes to be constructed for rural water supply in the whole state, in the three selected LGA's together and in the same three individually. The totals are:

TYPE OF SCHEME	NUMBERS TO BE CONSTRUCTED IN:	
	THE WHOLE STATE	THREE SEL. LGA'S
hand dug wells	1,835	396
shallow boreholes	1,556	117
spring captations	27	5
bulldozer dug ponds	82	6
deep boreholes	10	4

POPULATION OF ANAMBRA STATE NOT COVERED BY EXISTING AND PLANNED URBAN AND SEMI-URBAN WATER SUPPLY SCHEMES

LGA name	Popu-lation 1990	urban populatio with exis-ting piped schemes	non urban with exis-ting schemes	non urban with planned schemes	uncovered (persons)	uncovered (% of year 2000 popu-lation)	uncovered without over design (persons)
Abakaliki	462,224	110,000	24,000	350,836	106,811	18%	106,811
Aguata	486,969	229,000	62,159	181,358	150,803	24%	150,803
Anambra	387,240	0	70,000	243,634	182,033	37%	182,033
Awgu	332,326	0	71,000	137,230	217,147	51%	217,147
Awka	430,088	110,000	0	211,044	229,469	42%	229,469
Enugu	586,856	927,000	0	63,942	(239,766)	-32%	0
Ezeagu	214,616	25,000	73,000	139,005	37,703	14%	37,703
Ezza	271,786	0	0	116,756	231,130	66%	231,130
Idemili	212,493	0	152,444	241,608	(122,061)	-45%	0
Igbo-Etiti	232,240	0	142,000	124,864	30,403	10%	30,403
Igbo-Eze	307,980	0	78,000	173,702	142,512	36%	142,512
Ihiala	266,800	0	70,000	212,606	58,898	17%	58,898
Ikwo	170,598	0	0	110,335	108,030	49%	108,030
Ishielu	373,481	33,000	0	68,643	376,413	79%	376,413
Isi-uzo	272,957	0	60,000	190,465	98,920	28%	98,920
Njikoka	489,825	0	337,491	314,891	(25,406)	-4%	0
Nkanu	301,718	90,000	0	172,055	124,144	32%	124,144
Nnewi	354,235	0	182,749	207,153	63,519	14%	63,519
Nsukka	346,819	130,000	129,000	176,447	8,481	2%	8,481
Oji-River	119,095	0	69,000	100,503	(17,061)	-11%	0
Onitsha	673,282	500,000	0	54,610	307,191	36%	307,191
Udi	210,158	35,000	139,185	134,391	(39,574)	-15%	0
Uzo-Uwani	229,521	0	0	200,844	92,943	32%	92,943
Total	7,733,307	2,189,000	1,660,028	3,926,922	2,122,683	21%	2,566,551

So 2.5 million people to be classified as RURAL

HYPOTHETIC DISTRIBUTION OF RURAL POPULATION OVER FIVE GEOLOGICAL ZONES

LGA name	% of surface area in zone numbers:					number of rural people in zones (1990 * 1 zone numbers:				
	1	2	3	4	5	1	2	3	4	5
Abakaliki	97%	0%	0%	0%	3%	103,606	0	0	0	3,204
Aguata	0%	0%	34%	66%	0%	0	0	51,273	99,530	0
Anambra	0%	0%	20%	8%	72%	0	0	36,407	14,563	131,064
Awgu	58%	42%	0%	0%	0%	125,945	91,202	0	0	0
Awka	0%	0%	8%	92%	0%	0	0	18,357	211,111	0
Enugu	95%	5%	0%	0%	0%	0	0	0	0	0
Ezeagu	0%	17%	52%	31%	0%	0	6,410	19,606	11,688	0
Ezza	100%	0%	0%	0%	0%	231,130	0	0	0	0
Idemili	0%	0%	7%	0%	93%	0	0	0	0	0
Igbo-Etiti	7%	66%	27%	0%	0%	2,128	20,066	8,209	0	0
Igbo-Eze	0%	89%	11%	0%	0%	0	126,836	15,676	0	0
Ihiala	0%	0%	19%	0%	81%	0	0	11,191	0	47,707
Ikwo	88%	0%	0%	0%	12%	95,067	0	0	0	12,964
Ishielu	100%	0%	0%	0%	0%	376,413	0	0	0	0
Isi-uzo	91%	9%	0%	0%	0%	90,017	8,903	0	0	0
Njikoka	0%	0%	88%	18%	0%	0	0	0	0	0
Nkanu	100%	0%	0%	0%	0%	124,144	0	0	0	0
Nnewi	0%	0%	6%	0%	94%	0	0	3,811	0	59,708
Nsukka	10%	90%	0%	0%	0%	848	7,633	0	0	0
Oji-River	0%	26%	53%	21%	0%	0	0	0	0	0
Onitsha	0%	0%	0%	0%	100%	0	0	0	0	307,191
Udi	0%	55%	44%	1%	0%	0	0	0	0	0
Uzo-Uwani	0%	0%	24%	61%	15%	0	0	22,306	56,695	13,941
Total						1,149,299	261,050	186,836	393,587	575,779

ESTIMATE OF NUMBER OF SCHEMES NEEDED FOR RURAL WATER SUPPLY IN ANAMBRA STATE

ZONE	NATURE OF SUB SOIL / SIZE OF TARGET GROUP (INHABITANTS)	MAIN WATER RESOURCES	MOST APPRORIATE SCHEMES FOR RURAL WATER SUPPLY	NUMBER OF PEOPLE TO BE SERVED BY ONE SCHEME	% of PEOPLE TO BE SERVED	NUMBER OF SCHEMES TO CONSTRUCT
1	mainly shales	shallow ground water	hand dug wells	300	17	651
			shallow boreholes	300	17	651
	1,149,299	some springs	spring captation	600	1	19
		impounded surface water	bulldozer dug ponds with slow sand filter and pump	4,000	25	72
2	mainly sandstones	deep ground water	deep boreholes with overhead tank and some reticulation	20,000	59	8
	261,050	some springs	spring captation, but will in most cases be far away from settlements	600	1	4
3	sandstones	ground water	boreholes with handpumps	300	27	168
			handdug wells	300	27	168
	186,836	deep ground water	deep boreholes with overhead tank and some reticulation	12,000	5	1
		springs	spring captation	600	1	3
4	shales	shallow ground water	boreholes or	300	24	315
	393,587		handdug wells with high rate	300	24	315
		deep artesian ground water	expensive boreholes, low operational costs	12,000	2	1
		impounded surface water	bulldozer dug ponds with slow sand filter and pump	4,000	10	10
5	sandstones, sands, and	ground water	boreholes/ handpumps	300	29	422
			handdug wells	300	29	422
		springs	spring captation	600	2	15
	436,059					
	alluvial deposits	shallow ground water under alluvial plains	handdug wells	300	60	279
	139,720					

Summary of numbers needed:

hand dug wells	1,835
shallow boreholes	1,556
spring captations	27
bulldozer dug ponds	82
deep boreholes	10

ESTIMATE OF NUMBER OF SCHEMES NEEDED IN ANAMBRA, IGBO-EZE AND IKWO LGA

ZONE	NATURE OF SUB SOIL / SIZE OF TARGET GROUP (INHABITANTS)	MAIN WATER RESOURCES	MOST APPRORIATE SCHEMES FOR RURAL WATER SUPPLY	NUMBER OF PEOPLE TO BE SERVED BY ONE SCHEME	% of PEOPLE TO BE SERVED	NUMBER OF SCHEMES TO CONSTRUCT
1	mainly shales	shallow ground water	hand dug wells	300	17	54
			shallow boreholes	300	17	54
	95,067	some springs	spring captation	600	1	2
		impounded surface water	bulldozer dug ponds with slow sand filter and pump	4,000	25	6
2	mainly sandstones	deep ground water	deep boreholes with overhead tank and some reticulation	20,000	59	4
	126,836	some springs	spring captation, but will in most cases be far away from settlements	600	1	2
3	sandstones	ground water	boreholes with handpumps	300	27	47
			handdug wells	300	27	47
	52,083	deep ground water	deep boreholes with overhead tank and some reticulation	12,000	5	0
		springs	spring captation	600	1	1
4	shales	shallow ground water	boreholes or handdug wells with high rate	300	24	12
				300	24	12
	14,563	deep artesian ground water	expensive boreholes, low operational costs	12,000	2	0
		impounded surface water	bulldozer dug ponds with slow sand filter and pump	4,000	10	0
5	sandstones, sands, and	ground water	boreholes/ handpumps	300	29	4
			handdug wells	300	29	4
		springs	spring captation	600	2	0
	4,308			- - - - - - - - - - - - - - - - - - - -		
	alluvial deposits	shallow ground water	handdug wells	300	60	279
	139,720	under alluvial plains				

Summary of numbers needed:

hand dug wells	396
shallow boreholes	117
spring captations	5
bulldozer dug ponds	6
deep boreholes	4

ESTIMATE OF NUMBER OF SCHEMES NEEDED IN ANAMBRA LGA

ZONE	NATURE OF SUB SOIL / SIZE OF TARGET GROUP (INHABITANTS)	MAIN WATER RESOURCES	MOST APPRORIATE SCHEMES FOR RURAL WATER SUPPLY	NUMBER OF PEOPLE TO BE SERVED BY ONE SCHEME	% of PEOPLE TO BE SERVED	NUMBER OF SCHEMES TO CONSTRUCT
3	sandstones	ground water	boreholes with handpumps	300	27	33
			handdug wells	300	27	33
	36,407	deep ground water	deep boreholes with overhead tank and some reticulation	12,000	5	0
		springs	spring captation	600	1	1
4	shales	shallow ground water	boreholes or handdug wells with high rate	300	24	12
				300	24	12
	14,563					
		deep artesian ground water	expensive boreholes, low operational costs	12,000	2	0
		impounded surface water	bulldozer dug ponds with slow sand filter and pump	4,000	10	0
5	sandstones, sands, and	ground water	boreholes/ handpumps	300	29	4
			handdug wells	300	29	4
	4,308					
	alluvial deposits	shallow	handdug wells	300	60	254
	126,756	ground water under alluvial plains				

Summary of numbers needed:

hand dug wells	302
shallow boreholes	49
spring captations	1
bulldozer dug ponds	0
deep boreholes	0

ESTIMATE OF NUMBER OF SCHEMES NEEDED IN IGBO-EZE LGA

ZONE	NATURE OF SUB SOIL / SIZE OF TARGET GROUP (INHABITANTS)	MAIN WATER RESOURCES	MOST APPRORIATE SCHEMES FOR RURAL WATER SUPPLY	NUMBER OF PEOPLE TO BE SERVED BY ONE SCHEME	% of PEOPLE TO BE SERVED	NUMBER OF SCHEMES TO CONSTRUCT
2	mainly sandstones	deep ground water	deep boreholes with overhead tank and some reticulation	20,000	59	4
	126,836	some springs	spring captation, but will in most cases be far away from settlements	600	1	2
3	sandstones	ground water	boreholes with handpumps	300	27	14
			handdug wells	300	27	14
	15,676	deep ground water	deep boreholes with overhead tank and some reticulation	12,000	5	0
		springs	spring captation	600	1	0

Summary of numbers needed:

hand dug wells	14
shallow boreholes	14
spring captations	2
deep boreholes	4

ESTIMATE OF NUMBER OF SCHEMES NEEDED IN IKWO LGA

ZONE	NATURE OF SUB SOIL / SIZE OF TARGET GROUP (INHABITANTS)	MAIN WATER RESOURCES	MOST APPRORIATE SCHEMES FOR RURAL WATER SUPPLY	NUMBER OF PEOPLE TO BE SERVED BY ONE SCHEME	% of PEOPLE TO BE SERVED	NUMBER OF SCHEMES TO CONSTRUCT
1	mainly shales	shallow ground water	hand dug wells	300	17	54
			shallow boreholes	300	17	54
	95,067	some springs	spring captation	600	1	2
		impounded surface water	bulldozer dug ponds with slow sand filter and pump	4,000	25	6
5	alluvial deposits	shallow ground water	handdug wells	300	60	26
	12,964	under alluvial plains				

Summary of numbers needed:

hand dug wells	80
shallow boreholes	54
spring captations	2
bulldozer dug ponds	6
deep boreholes	0

Cost estimates of water supply options.

Estimated Cost of Boreholes (Naira)

Item	Description	150 mm dia		200 mm dia		250 mm dia		300 mm dia	
		100 m	200 m	100 m	200 m	100 m	200 m	100 m	200 m
1	Drill to depth not exceeding 7 m	910	910	1050	1050	1050	1050	1050	1050
2	Ditto but not exceeding 100 m	13950	13950	17391	17391	18600	18600	20181	20181
3	Ditto but exceeding 100 m and not exceeding 200 m		18000		20400		25000		25300
4	Supply and install conductor pipe	840	840	1050	1050	1050	1050	1120	1120
5	Supply and install inner A.P.I. casing pipe	8987	19987	11274	25074	16340	36340	20915	46515
6	Supply and place Johnson screen and blind pipe	11071	11071	13874	13874	17568	17568	20167	20167
7	Supply and place adequate gravel pack	3600	7600	4410	9310	4410	9310	4410	9310
8	Grout annular space around conductor pipe and permanent casing	1032	1032	1290	1290	1290	1290	1290	1290
9	Grout top 10 m of borehole	573	573	716	716	716	716	716	716
10	Lump sum to include mobilization, preparing site setting up development of borehole, testing, logging, geophysical investigation and water analysis	29200	29200	33600	33600	33600	33600	33600	33600
		70163	103163	84655	123755	94624	144524	103449	159249

Summary of estimated cost of boreholes

Diameter mm	Depth 100 m		Depth 200 m	
	Naira	US $	Naira	US $
150	70163	9480	103163	13940
200	84655	11440	123755	16720
250	94624	12790	144524	19530
300	103449	13980	159249	21520

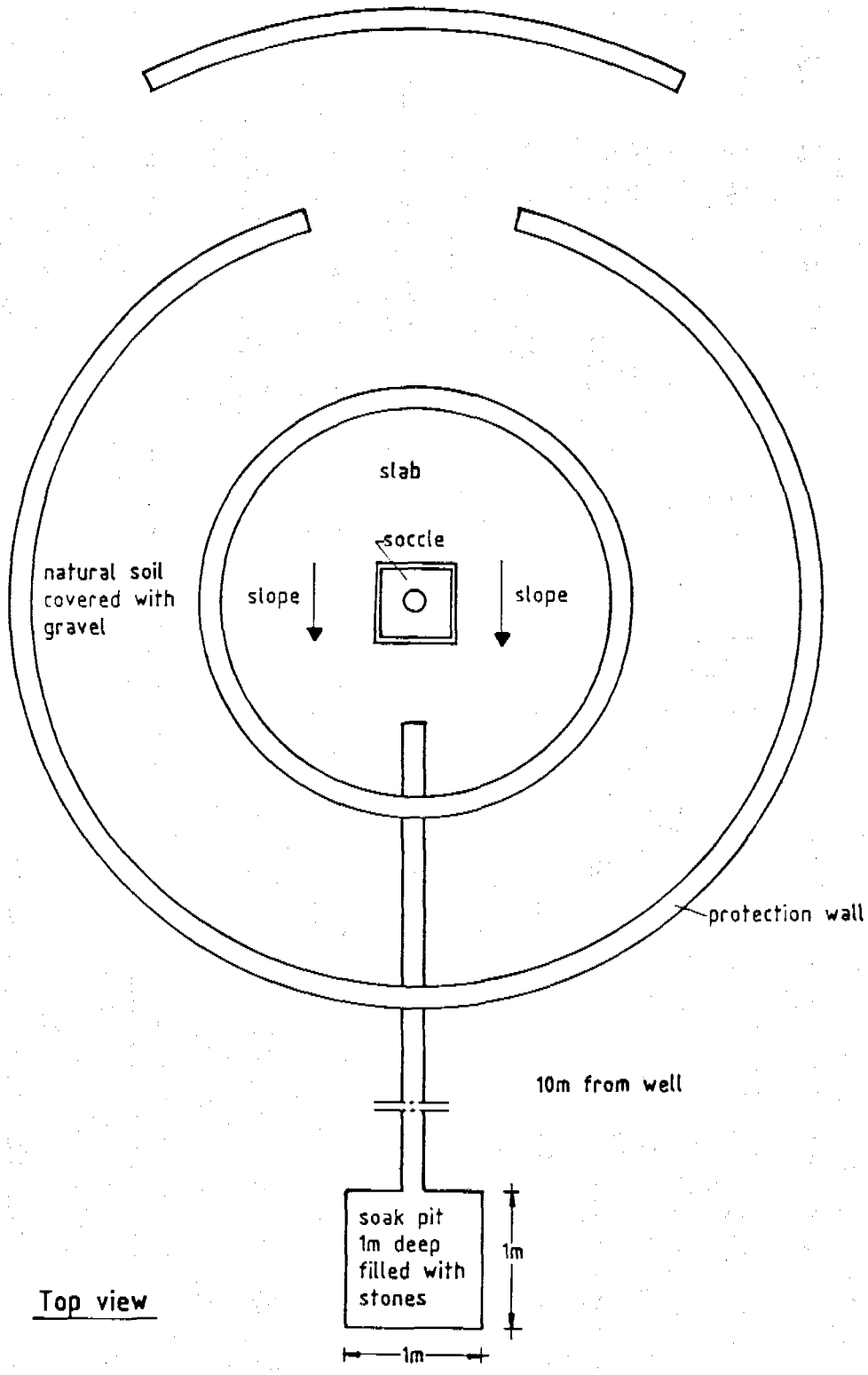
Note: US $ 1.00 = N 7.4 (mid February 1989)

UNIT RATES FOR WATER SUPPLY SCHEMES
(Contractors Prices - February 1989)

Handpump	N 2336
Dug well	
(a) (depth up to 10 m - incl. handpump)	N 16000
(b) (depth up to 15 m - incl. handpump)	N 29000
Catchment pond	
(a) pond	N 48000
(b) slow sand filter	N 34000
Shallow borehole (dia. 150 mm - depth 60 m - incl. handpump)	N 76000
Deep borehole (dia. 250 mm - depth 200 m)	N 144500
Supply of deepwell pump (incl. cables, switches, etc.)	N 70000
Supply of genset (125 KVA)	N 150000
Installation of pump & genset	N 10000
Genset house small	N 25000
Genset house standard	N 45000
Supply and installation of steel Overhead tank (100.000 gallons)	N 700000
Supply and laying of pipes	
150 mm AC	N 110 per m'
100 mm AC	N 66 per m'
2 mm GI	N 35 per m'
1 mm GI	N 15 per m'
Standpipe	N 350
Reinforced concrete reservoir (groundlevel, 90 m^3)	N 56000
Small GI reservoir	N 1000
Spring captation	N 30000

Cost of deep borehole schemes

175 m deep		300 mm dia	150 m deep		250 mm dia
2x boreholes		289,000			240,000
Submersible pump		70,000			70,000
Genset (70 kVA)		120,000			100,000
Installation		10,000			10,000
Gen house		45,000			25,000
Elevated tank		700,000			400,000
Reticulation		990,000			660,000
Standpipes		12,000			7,000
	N	2.236,000		N	1.512,000



Client
RWSG , UNDP / World Bank

Project
RWS & S Anambra State , Nigeria

Description
Superstructure for boreholes

Drawn
HvD

Figure number
.

Approved
.

Date
04-'89

Drawing number
1805-.

IWACO
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P.O. Box 183, 3000 AD Rotterdam
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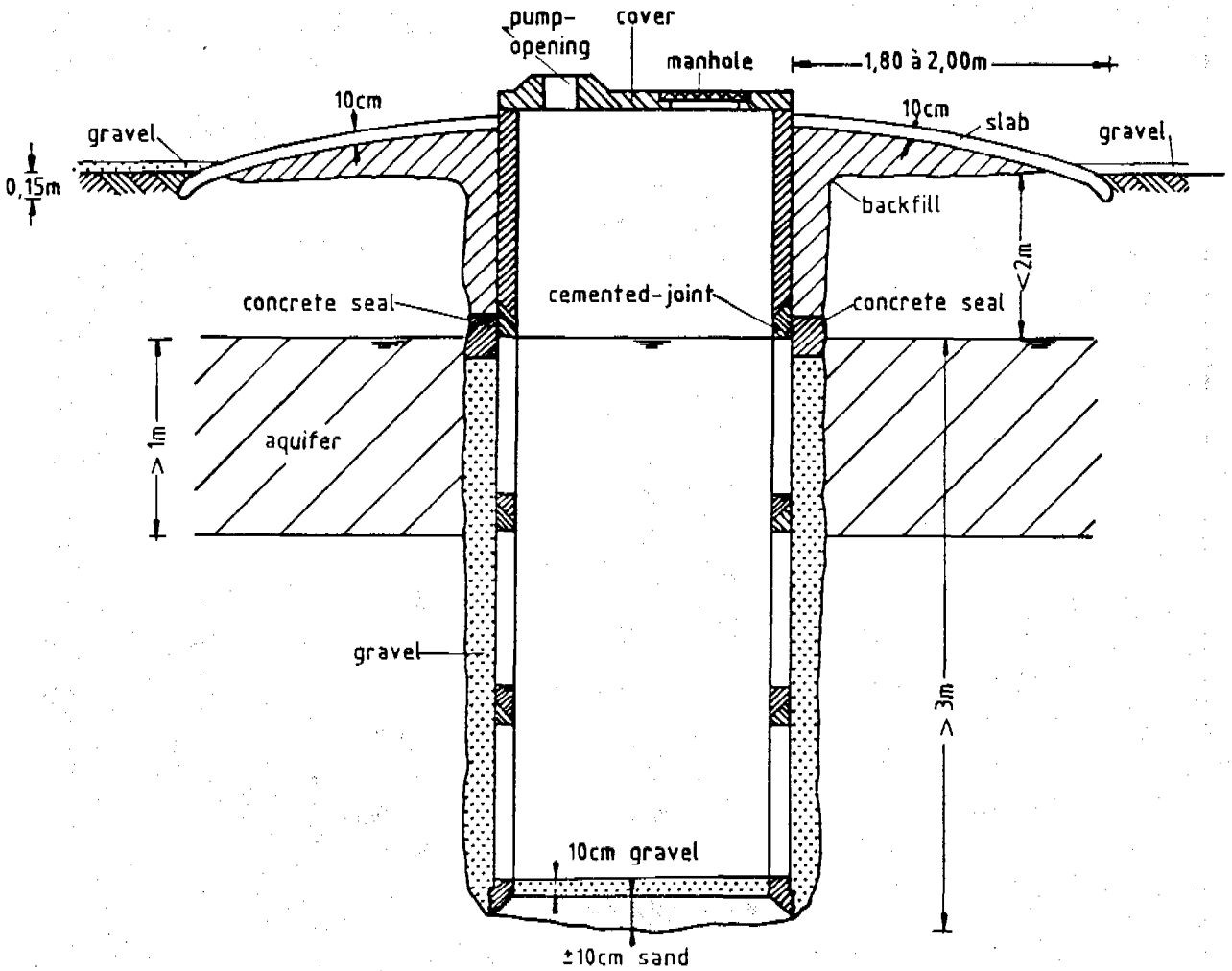
The Netherlands



Standard well (type A) after DHV (1979)

Client
RWSG , UNDP / World Bank

Project
RWS & S Anambra State , Nigeria

Description
Standard well

Drawn
HvD

Figure number

Approved

Date
04-'89

Drawing number
1805-

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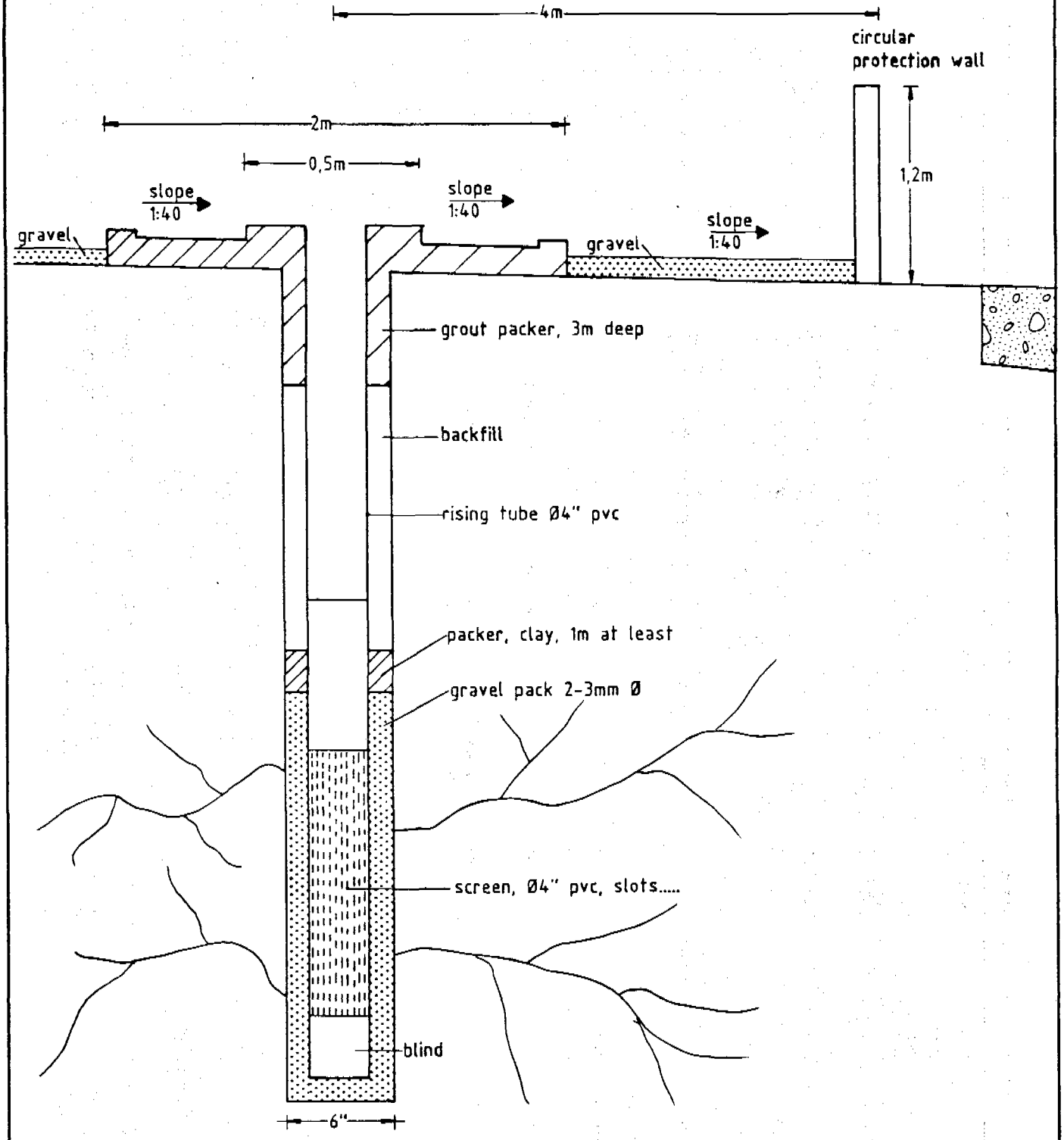
Annex 8.2



Client
RWSG , UNDP / World Bank

Project
RWS & S Anambra State , Nigeria

Drawn
HvD

Figure number
.

Approved
.

Date
04-'89

Drawing number
1805-.

Description
Sketch of shallow borehole

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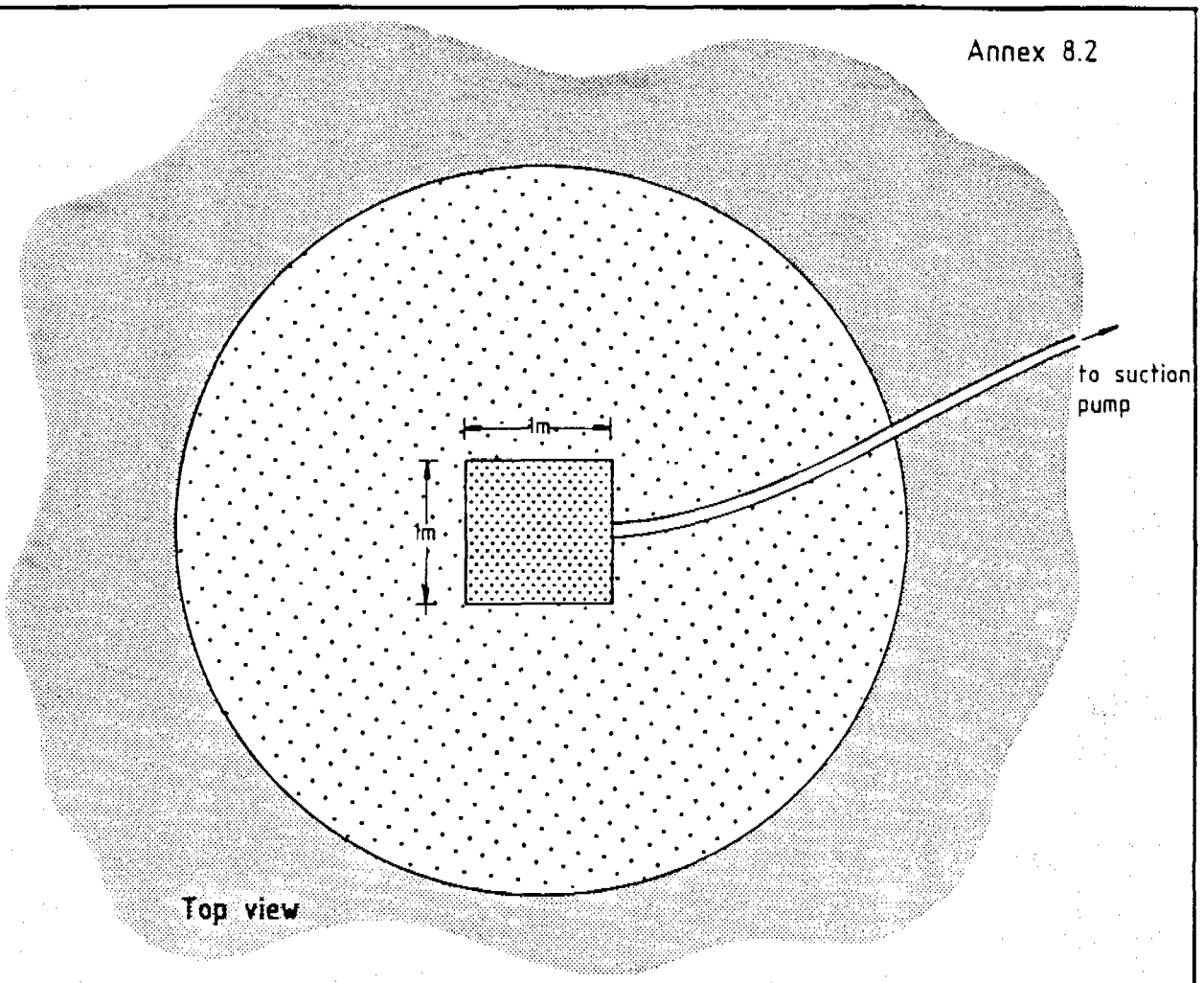
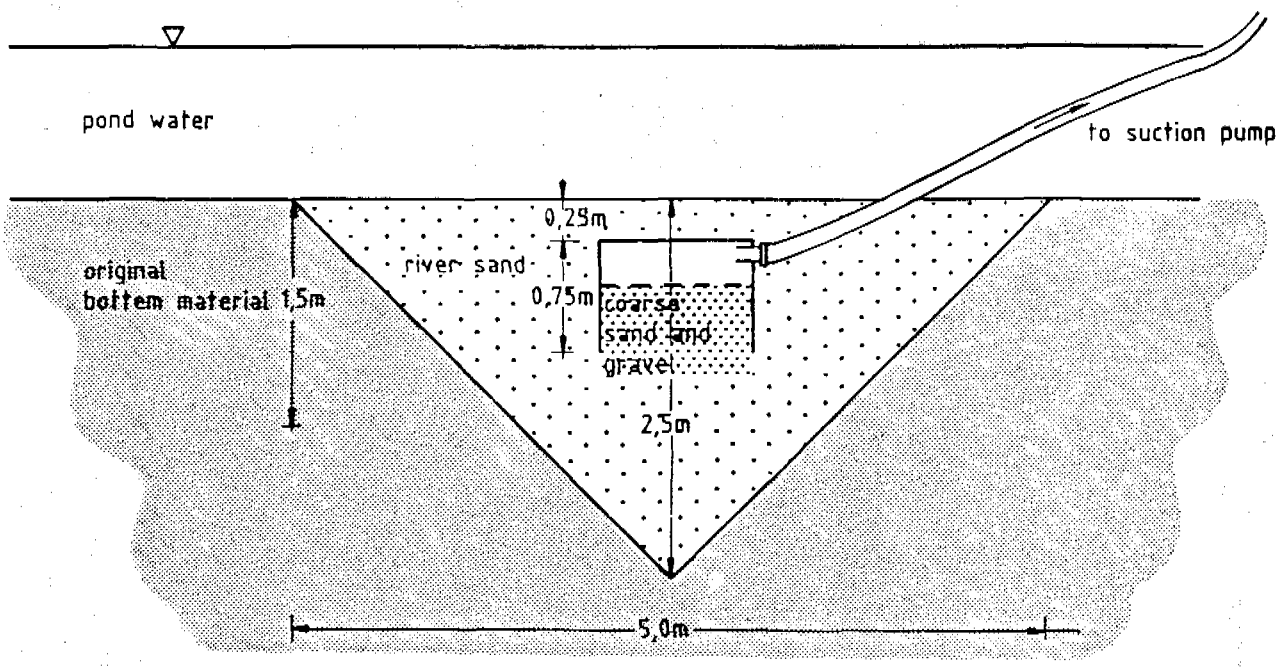
The Netherlands

Annex 8.2





cross section

Client
RWSG , UNDP / World Bank

Project
RWS & S Anambra State , Nigeria

Drawn
HvD

Approved
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Figure number
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Date
04-'89

Description
Sketch of filtration unit for storage pond

Drawing number
1805-.

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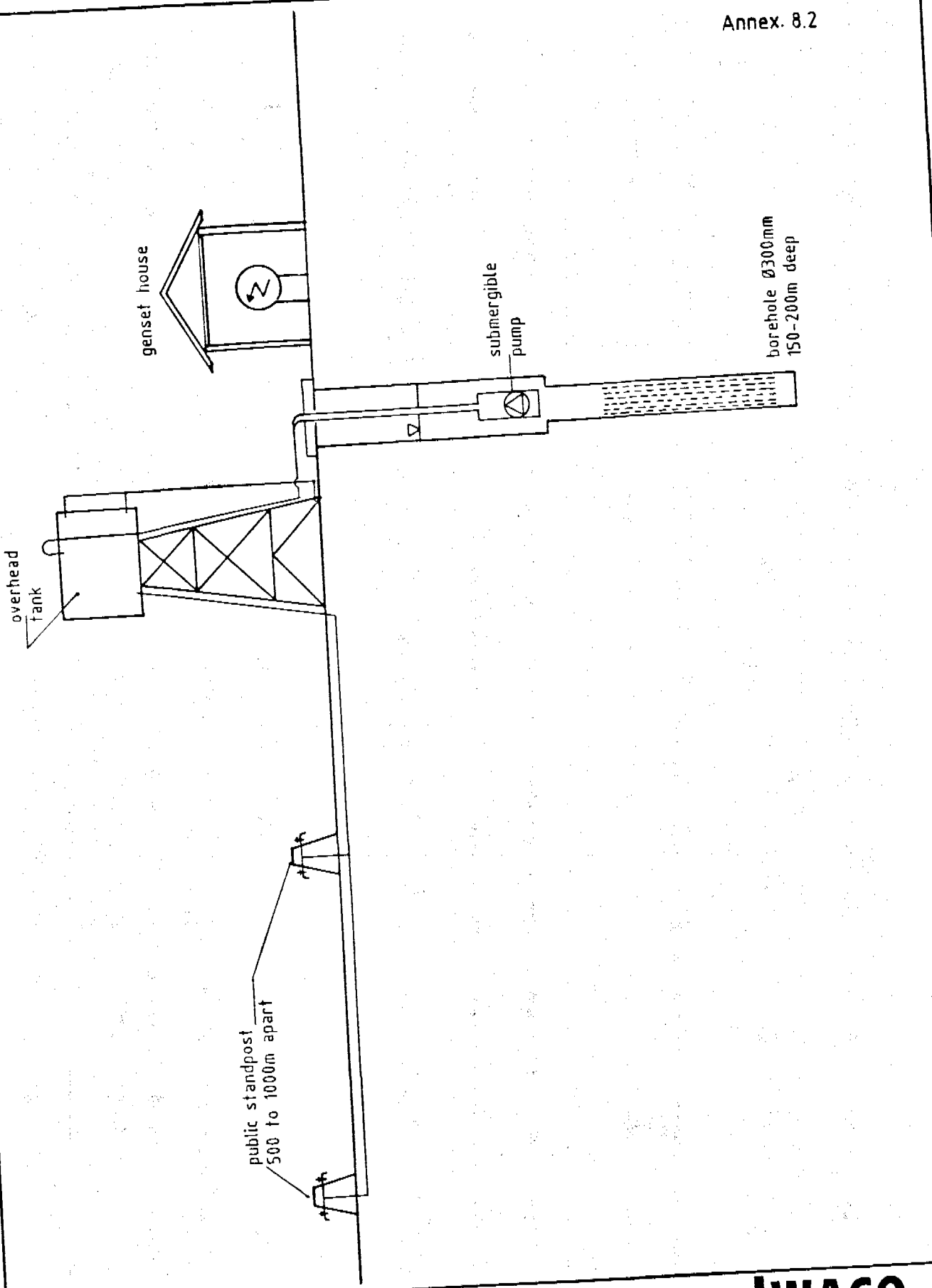

Client
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Project
RWS & S Anambra State , Nigeria

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Figure number
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Date
04-'89

Drawing number
1805-.

Description Sketch of deep borehole with overhead tank and simple reticulation system

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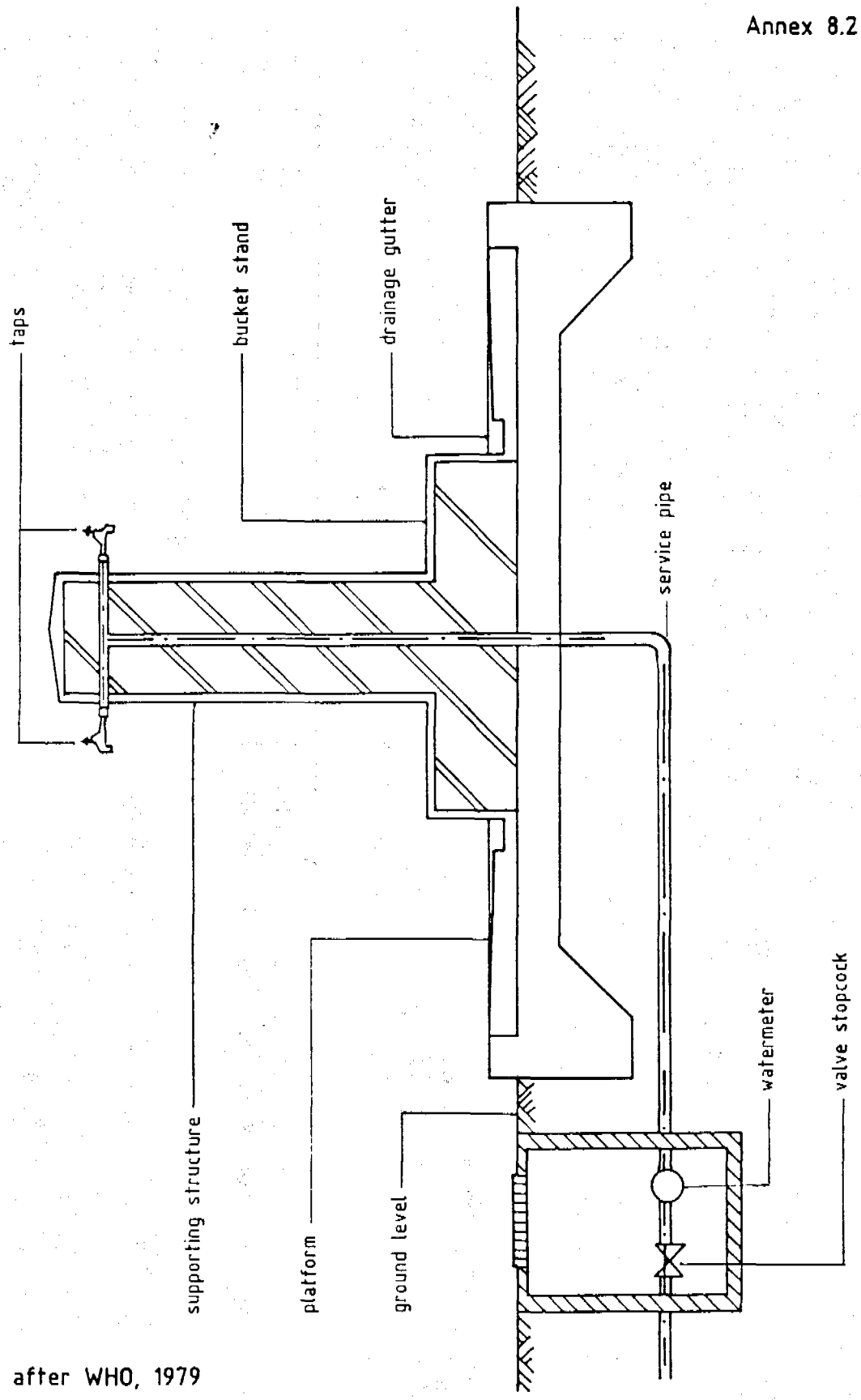

after WHO, 1979

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Project
RWS & S Anambra State , Nigeria

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Date
04-'89

Drawing number
1805-.

Description
Cross-section of a public standpost

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Unit costs of water of various options for rural water supply.

Depreciating cost of hand dug well fitted with handpump.

Cost of well over 15 years
Cost of pump over 5 years

$\frac{26000}{15} + \frac{2336}{5}$ = N 2200

Depreciating cost of shallow borehole fitted with handpump

Cost of borehole over 15 years
Cost of pump over 5 years

$\frac{73000}{15} + \frac{2336}{5}$ = N 5334

Depreciating cost of spring captation

Cost of captation over 15 years

$\frac{30000}{15}$ = N 2000

Depreciation of catchment pond with Slow Sand Filter

Cost of pond over	15 years	$\frac{48000}{15}$ =	3200
Cost of Sand Filter over	30 years	$\frac{34000}{30}$ =	1133
Cost of pump over	5 years	$\frac{2336}{5}$ =	467
		N	4800

Depreciation costs of borehole scheme for 20,000 population

Depreciation	: Civil works and piping		30 year
	Non moving equipment		15 years
	Pumps and genset		5 year
Depreciation over 30 years	: 2 x boreholes		289,000
	genhouse		45,000
	reticulation		990,000
		N	1,324,000

i.e. N 44,133/year

Depreciation over 15 years	: elevated tank		700,000
	stand pipes		12,000
		N	712,000

i.e. N 47,467/year

Depreciation over 5 years	: submersible pump		70,000
	genset		120,000
		N	190,000

i.e. N 38,000/year

Total depreciation per year is N 129,600

i.e. N 6.48/capita

Depreciation costs of borehole scheme for 12,000 population

Depreciating over 30 years	: 2 x boreholes	240,000
	genhouse	25,000
	reticulation	660,000
		925,000

i.e. N 30833/year

Depreciating over 15 years	: elevated tank	400,000
	standpipes	7,000
		407,000

i.e. N 27133/year

Depreciating over 5 years	: submersible pump	70,000
	genset	100,000
		170,000

i.e. N 34000/year

Total depreciation per year is N 91,966

i.e. N 7.66/capita

Annual running cost of borehole scheme for 20,000 population

Fuel costs

Assumptions :	borehole average abstraction	50 m^3/hr
	pumping head is	175 m
	water demand is	20 l/c/d
	fuel consumptions is based on 150 kVA generation	0.283 l/hr/kW
	efficiency of pumps is	70 %
	cost of diesel is	N 0.35/l

Water consumption/day for 20,000 is 400 m^3/day

Number of hours/day pumping is required in $\frac{400}{50}$ = 8 hrs

Power size of generator required assuming 0.8 kVA approximately to 1 kWh. Power requirement:

Required capacity = 43 kVA

Apply factor of 1,5 to cover start up load requirement = 65 kVA

use a 70 kVA generator

Fuel consumption is 0.283 x 8 x 70 l/day = 158.5 l/day

Assumed generator works 8 hrs/day during the dry season (6 months) and 4 hrs/day during the wet season (6 months)

fuel consumption/year is:
158.5 x 9 months x 30 day/month = 42795 l

fuel cost/year at N 0.35/l is N 14,978
Say N 15,000

Cost of 2 attendants/mechanics plus 2 watchman is

18,250 + 5475 = N 23,725/year

Total running cost/year is N 38,725

or

N 1.94/capita/year

Annual running cost of borehole scheme for 12,000 population

Fuel costs

Assumptions	:	borehole average abstraction	30 m^3/hr
		pumping head	145 m
		water demand	20 l/c/d
		fuel consumption is based on kVA generation	0.283 l/hr/kw
		efficiency of pump is	70 %
		cost of diesel is	N 0.35/l

Water consumption/day for 12000 is 240 m^3

Number of hours/day pumping is required is $\frac{240}{30}$ = 8 hrs

Power size of generator required assuming 0.8 kVA approximates to one kW. Power requirements:

Required capacity: = 17/0,8 = 21 kVA

Apply factor of 1,5 to cover start up load requirement = 32 kVA

use a 34 kVA generator

Fuel consumption is 0.283 x 8 x 34 l/day = 77 l/day

Assuming the generator works 8 hrs/day during the dry season (6 months) and 4 hrs/day during the wet season.

Fuel consumption/year is:
77 x 9 months x 30 day/month = 20790 l

fuel cost/year at N 0.35/l is N 7,276
Say N 7,300

Cost of 2 attendants/mechanics plus 2 watchman is 18250 + 5475 = N 23,725/year

Total running cost/year is N 31,025
or
N 2.59/capita/year

Maintenance costs

It must be assumed that the maximum distribution from both a hand dug well and a shallow borehole both fitted with a handpump is 300 persons. This is based on an average handpump capacity of 0.25 l/s (i.e. 7200 l/d for an 8 hour day). Assuming 20% usage for bucket washing, this leaves approximately 6000 l/d or 20 l/c/d.

The following handpump maintenance costs have been derived primarily from "A village level operation and maintenance system for Watsan Project handpump equipped boreholes in Nigeria." published by UNICEF - Nigeria, December 1988.

Labour costs/year for routine inspection	N 10.00
Labour costs/year for servicing	N 80.00
Sundry charges (i.e. cutting rod threads etc.)	N 30.00
Recommended spare parts/pump/year	N 280.00
	N 400.00

Maintenance costs of both the hand dug well and the shallow borehole will be the same except that in the case of the hand dug well an allowance must be made to periodically deepen it.

1) Annual maintenance cost of hand dug well;

Pump maintenance	N 400.00
Cost of periodically deepening well	N 200.00
	N 600.00
Annual maintenance cost/capita = 600/300 =	N 2.00

2) Annual maintenance cost of shallow borehole;

Pump maintenance only	N 400.00
Annual maintenance cost/capita = 400/300 =	N 1.33

3) The annual maintenance of a spring captation will consist of periodically replacing tap washers and occasionally replacing a complete tap unit.

Annual maintenance cost of a spring captation	N 60.00
Annual maintenance cost/capita = 60/600 =	N 0.10

4) The annual maintenance of a catchment pond with slow sand

filter and taps will consist of keeping the sides of the pond clear of growth, cleaning the filter, washing the sand, replacing sand and replacing tap washers and/or tap units. It is assumed that the slow sand filter is designed to serve 4000 people consuming 20 l/c/d i.e. 80 m3/d. If the filtration rate is 0.1 m/hr, or 2.4 m/d, the area of the filter will be 80/2.4 i.e. 33.3 m2, say 40 m2.

It is assumed that the sand bed is 1.00 m deep i.e. 40 m3 of washed sieved sand will be required and it is usual for upto 20% of the sand to be replaced per annum (in this case 8 m3/yr).

The annual maintenance costs are usually assumed to ammount to approximately 3% of the capital cost which in this case is 3% of N 34,000 = N 1030.00

There will also be an additional casual labour requirement of 28 days/year for cleaning the filter, washing the sand, and keeping the pond sides clear of growth. (@ N 15.00/day minimum rate) = N 420.00

The maintenance of the taps is a prorater from the spring captation, i.e. 4000/600 . 60 = N 400.00

Annual maintenance cost of a catchment pond with slow sand filter and taps is; N 1850.00

and the annual maintenance cost/capita is;

1850/4000 = N 0.46

5) Based upon similar layouts the typical annual maintenance cost of a borehole/reticulation scheme is 3% of total capital cost and includes wages of all labour associated specifically to maintenance work.

a) For 300 mm borehole, 175 m deep capital cost is;

2 No.	boreholes	N 289,000
9 km.	reticulation	N 990,000
1 No.	genhouse	N 45,000
1 No.	genset	N 120,000
1 No.	submersible pump	N 70,000
1 No.	elevated tank (large)	N 700,000
33 No.	standpipes	N 12,000
	installation of pumps and gensets	N 10,000
		N 2,236,000

Annual maintenance cost is 3% of N 2,226,000

= N 67,080

therefore annual maintenance cost/capita = 67,080/20,000

= N 3.35

b) For 250 mm borehole, 150 m deep capital cost is;

2	No.	boreholes	N 240,000
6	km.	reticulation	N 660,000
1	No.	genhouse	N 25,000
1	No.	genset	N 100,000
1	No.	submersible pump	N 70,000
1	No.	elevated tank (medium)	N 400,000
20	No.	standpipes	N 7,000
		installation of pumps and gensets	N 10,000
			N 1,512,000

Annual maintenance cost is 3% of N 1,512,000
= N 45,360

therefore annual maintenance cost/capita = 45,360/12,000

= N 3.78

Annual running costs.

1) The only annual running cost of the hand dug well will be the wages of the pump attendant. It is assumed that he/she will be in attendance for 50% of the time and therefore the wages are estimated as being 50% of the casual labour rate.
i.e. N 8.00/day.

Annual running cost of the hand dug well is; N 3,000.00

and annual running cost/capita is; 3000/300 = N 10.00

2) The annual running cost of the shallow borehole is similar to that of the hand dug well.

Annual running cost of the shallow borehole is; N 3,000.00

and annual running cost/capita is; N 10.00

3) The annual running cost of the spring captation will be limited to the wages of the attendant which it is estimated will only be 50% of the time that is required to attend a handpump site.

Annual running cost of the spring captation is; N 1,500.00

and annual running cost/capita is; 1500/600 = N 2.50

4) The annual running cost of the catchment pond will be the wages of the attendant who will look after the slow sand filter and ensure that the taps are working correctly. He/she will be graded in the same way as the hand pump attendant.
Annual running cost of the catchment pond is; N 3,000.00

and annual running cost/capita is; 3000/4000 = N 0.75

Total annual cost/capita.

The total annual cost/capita is derived from summing the following;

a) the annual maintenance cost/capita
b) the annual depreciating cost/capita
c) the annual running cost/capita

1) The total annual cost/capita for the hand dug well equipped with a hand pump is; 2.00 + 7.33 + 10.00 = N 19.33

2) The total annual cost/capita for the shallow borehole equipped with a hand pump is; 1.33 + 17.78 + 10.00 = N 29.11

3) The total annual cost/capita for the spring captation is;
0.10 + 3.33 + 2.50 = N 5.93

4) The total annual cost/capita for the catchment pond is;
0.46 + 1.20 + 0.75 = N 2.41

5) The total annual cost/capita for the 300 mm borehole, 175 m deep with submersible pump and reticulation scheme is;
3.34 + 6.48 + 1.94 = N 11.76

6) The total annual cost/capita for the 250 mm borehole, 150 m deep with submersible pump and reticulation scheme is;
3.76 + 7.66 + 2.59 = N 14.01

Cost per M3 water

The cost per M3 water is found by dividing the total annual cost/capita by the total annual consumption/capita.

The basic assumptions made in determining maintenance costs indicate a water consumption of 20 l/c/d if a hand pump is used. This equates to an annual consumption/capita of 7.3 m3.

For direct cost comparison purposes it is assumed that the consumption of water from the alternative systems which have been

considered, all of which use taps for delivery, is the same i.e. 20 l/c/d. It is acknowledged that in practice the consumption/-capita from a tap system will be in excess of this figure.

1) The cost per m3 water from a hand dug well equipped with a hand pump is;

19.33/7.3 = N 2.65

2) The cost per m3 water from a shallow borehole equipped with a hand pump is;

29.11/7.3 = N 3.99

3) The cost per m3 water from a spring captation equipped with taps is;

5.93/7.3 = N 0.81

4) The cost per m3 water from a catchment pond equipped with slow sand filter and taps is;

2.41/7.3 = N 0.33

5) The cost per m3 water from a 300 mm borehole, 175 m deep, equipped with submersible pump and 9 km. of reticulation is;

11.76/7.3 = N 1.61

6) The cost per m3 water from a 250 mm borehole, 150 m deep, equipped with submersible pump and 6 km. of reticulation is;

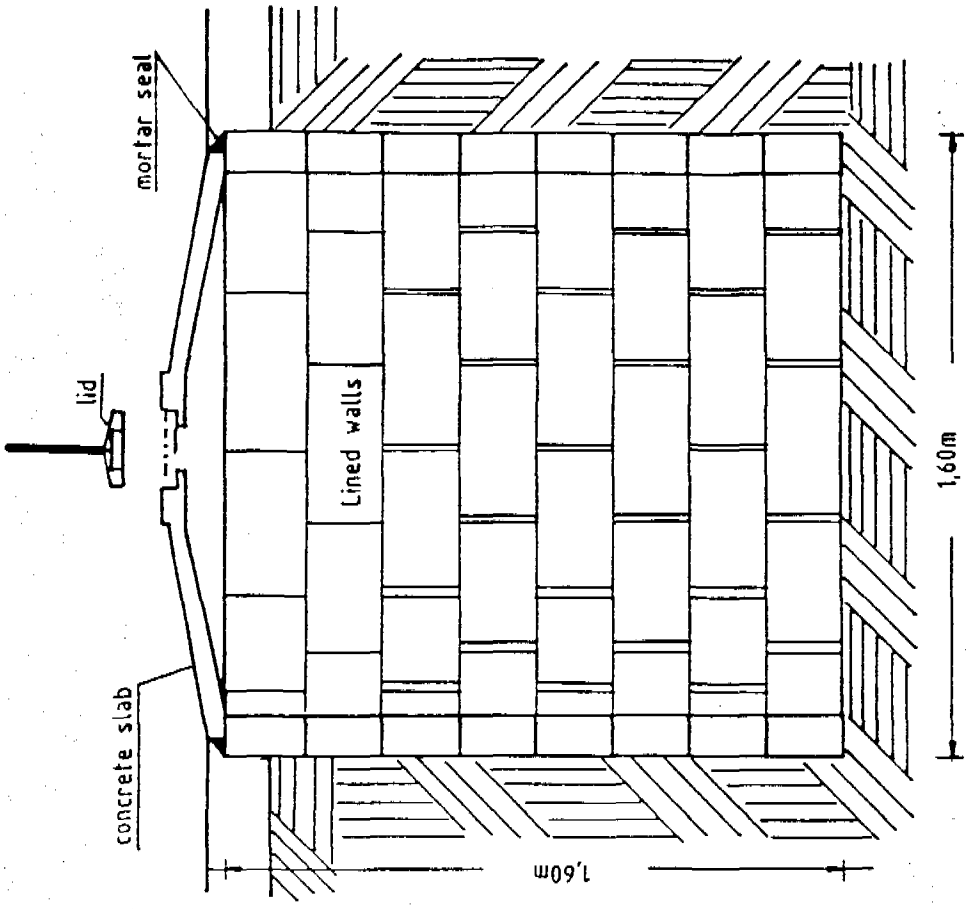
14.01/7.3 = N 1.92

Cost estimates of the various sanitation options.

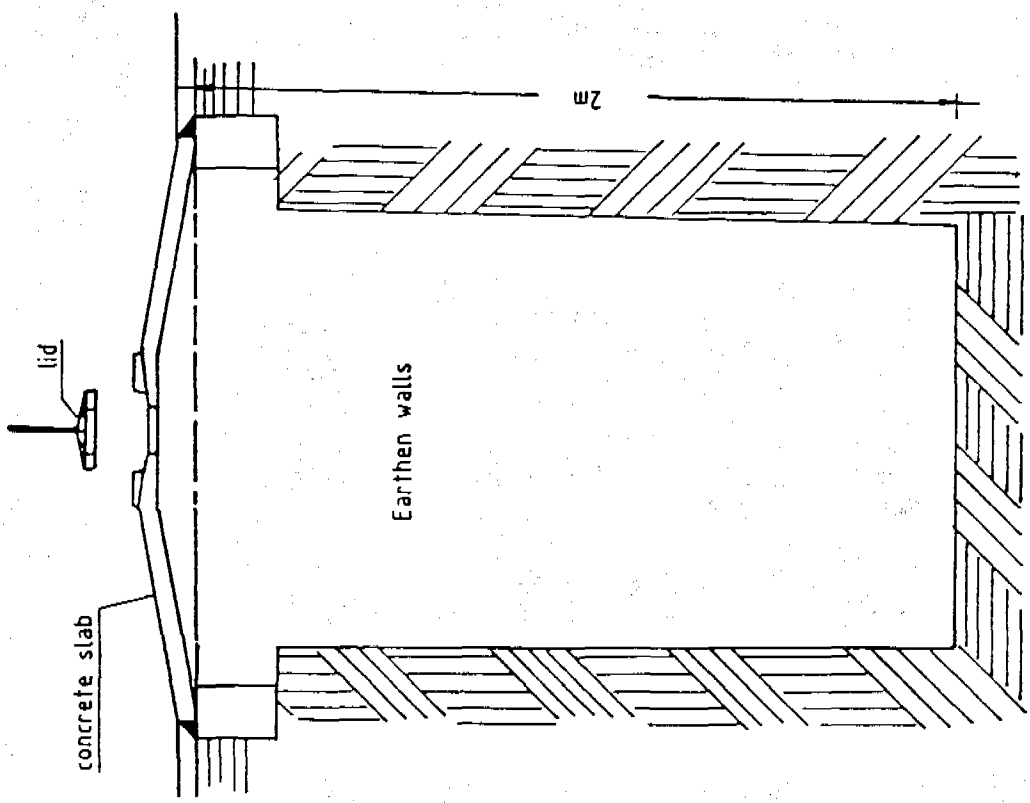
Estimate for material and skilled labour requirements to construct a simple rural latrine based on Moçambique design.

Materials	Unit	Quantity	Rate	Amount
Cement for slab	bag	2/3	43.00	29.00
Foundation blockwork	No.	III	2.50	30.00
				59.00
Labour requirement				
Skilled labour	Day	1	25.00	25.00
				84.00
Blockwork lining if required	No.	72	2.50	180.00
cement for mortar	Bag	1	43.00	43.00
Additional skilled labour	Day	1	25.00	25.00
				332.00
Cost of blockwork vent pipe				
Blockwork	No.	12	2.50	30.00
Cement-mortar	Bag	1/3	43.00	14.30
Fly screen	Sq fr	2	2.00	4.00
Skilled labour	Day	1/2	25.00	12.50
				60.80

Annex 8.4



The lined pit for less stable soils



The unlined pit with a slab for stable soil

Client
RWSG , UNDP / World Bank

Project
RWS & S Anambra State , Nigeria

Drawn
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Figure number
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Approved
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Date
04-'89

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The Netherlands

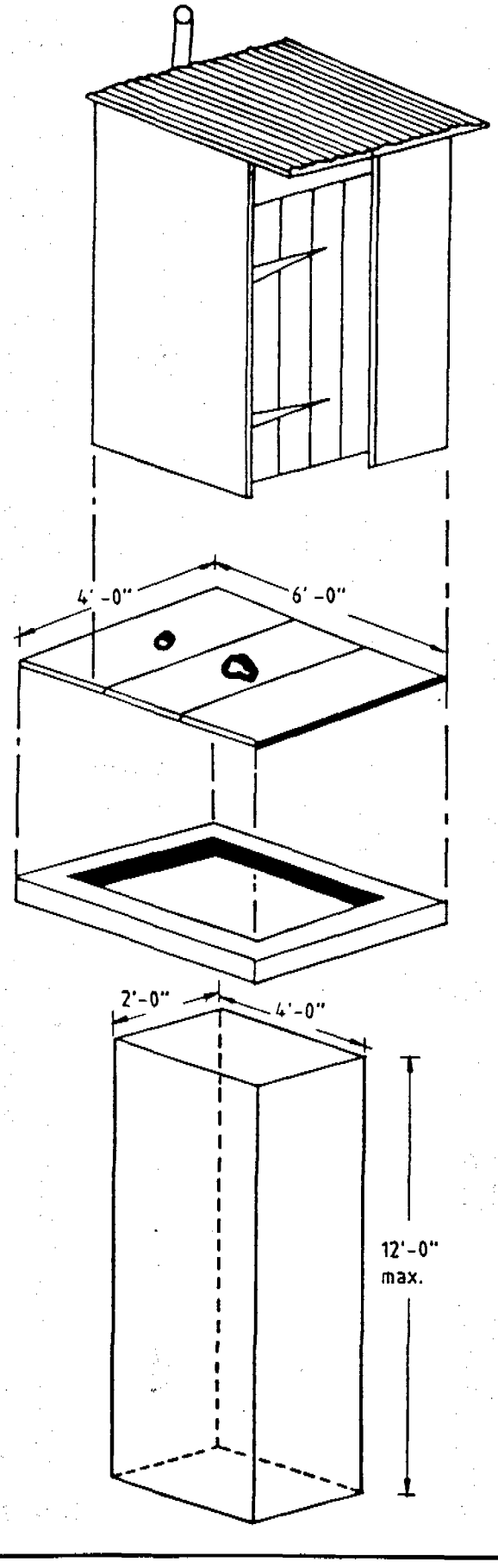
Description
Moçambique type pit latrine

Drawing number
1805-.

UNICEF SPECIFICATION FOR DOMESTIC SINGLE-PIT VIP LATRINE

Materials required for constructing one latrine:- (4ft x 2ft x 12ft deep) including wooden super structure framework and door with fittings.

Materials	Unit	Quantity	Rate (Naira)	Amount (Naira)
Cement	bag	2	43.00	86.00
Sand	cu.ft	5		
Aggregate (3/8in - 3/4in stones)	cu.ft	10	1.00	15.00
Steel reinforcing bars (30ft x 3/8in dia)	No.	3	40.00	120.00
Binding wire	bundle	1	8.00	8.00
Timber: (for shuttering)				
3in x 2in x 12ft softwood	No.	3	10.00	30.00
6in x 1in x 12ft softwood	No.	4	10.00	40.00
Nails (2in, 3in, 4in and roofing if required)	lb.wt.	3	10.00	30.00
Aluminium or stainless steel mosquito-proof netting	sq.ft.	2	2.00	4.00
Vent pipe, 9" x 9" x 18" Hollow conc. block	No.	12	2.50	30.00
		Subtotal		363.00
Materials for superstructure as locally available; they may include:				
- 2 in x 2in x 12ft softwood for framing	No.	12	5.00	60.00
- corrugated iron/asbestos sheets for roofing (6ft x 2ft 6in)	No.	3	25.00	75.00
- door + frame + hinges	No.	1	68.00	68.00
- barrel bolt	No.	2	7.00	14.00
- padlock staple	No.	1	8.00	8.00
- Solignum-type wood preservative	gal.	0.5	30.00	15.00
- local cladding material	item	1	No cost	
				603.00
Lining of pit: 6" x 8" x 18" Concblock	No.	120	2.50	300.00
(if required) Cement	bag	1	43.00	43.00
Sand	cu.ft	5	1.00	5.00
Labour requirements				
Skilled labour	Day	4	25.00	100.00
Unskilled labour	Day	7	15.00	105.00
				1156.00



vent & flyscreen

superstructure

cover slab

foundation
or ringbeam

pit

Client
RWSG , UNDP / World Bank

Project
RWS & S Anambra State , Nigeria

Drawn
HvD

Figure number
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Approved
.

Date
04-'89

Description
Components of single-pit VIP latrine

Drawing number
1805-.

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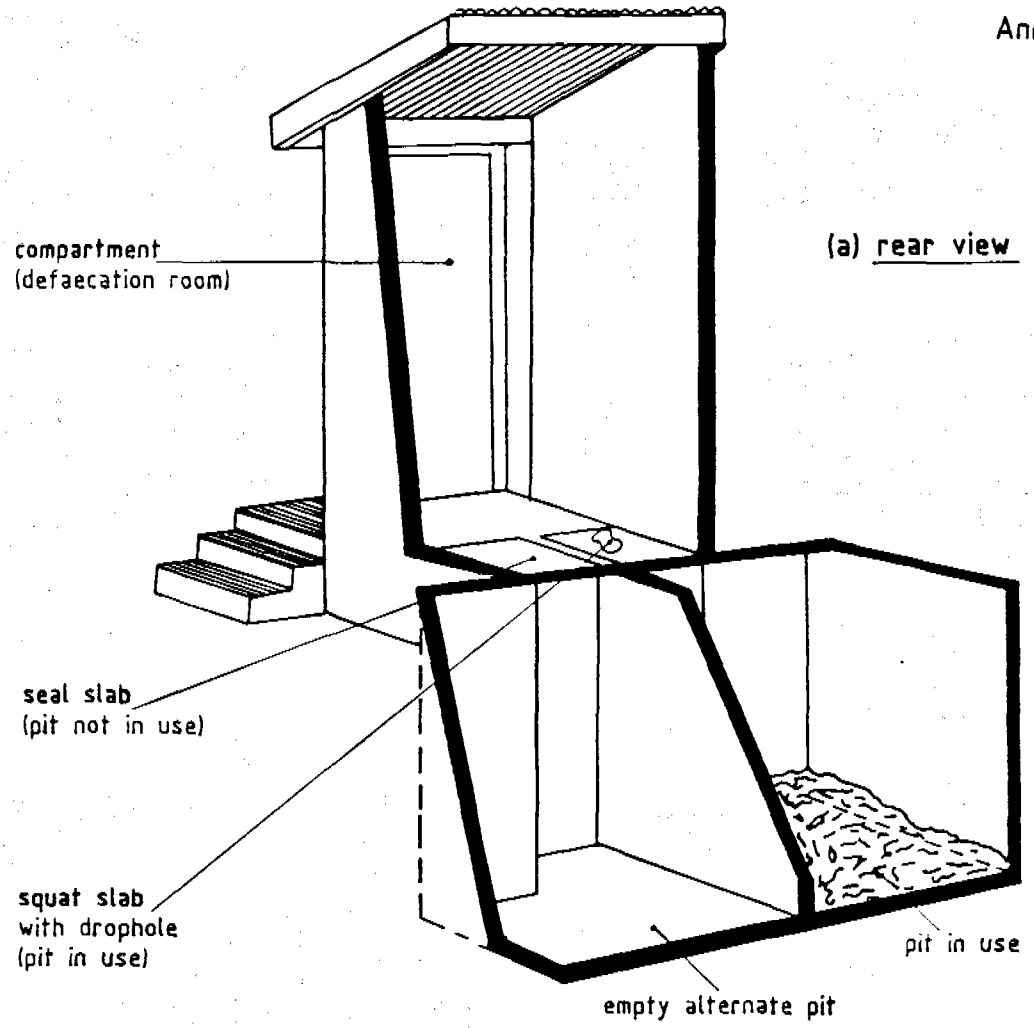
UNICEF SPECIFICATION FOR DOMESTIC ALTERNATING-PIT VIP LATRINE

Materials required for construction one latrine:

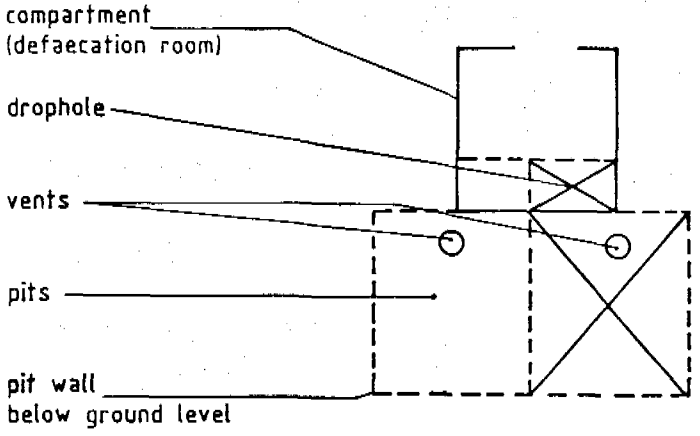
Material	Unit	Quantity	Rate	Amount
9in x 9in x 18in sand-cement block, vent pipe	No.	24	2.50	60.00
6in x 9in x 18in sand-cement block	No.	120	2.50	300.00
4in x 9in x 18in sand-cement block	No.	90	2.50	225.00
Cement	bag	15	43.00	645.00
Sand - sharp and smooth	cu.yd	5	25.00	125.00
Aggregate (3/8in - 3/4in stones)	cu.yd	2	25.00	50.00
Steel reinforcing bars (30ft x 3/8in dia)	No.	4	40.00	160.00
Binding wire	bundle	1	8.00	8.00
Timber:				
2in x 2in x 12ft softwood	No.	2	8.00	16.00
3in x 2in x 12ft softwood	No.	5	10.00	50.00
6in x 1in x 12ft softwood	No.	5	10.00	50.00
Nails (2in, 3in, 4in and roofing)	lb.wt.	5	10.00	50.00
Aluminium or stainless steel mosquito-proof netting	sq.ft.	4	2.00	8.00
Corrugated iron/asbestos (6ft x 2ft 6in) sheets	No.	3	25.00	75.00
Tee hinges with screws	No.	2	4.00	8.00
Padlock staple with screws	No.	1	8.00	8.00
Barrel bolts with screws	No.	2	7.00	14.00
Door complete with frame	No.	1	60.00	60.00
Emulsion paint	gal.	2	30.00	60.00
Gloss paint	gal.	0.5	80.00	40.00
Solignum-type wood preservative	gal.	0.25	30.00	8.00
		Subtotal		2020.00
Allow 10% additional cost for water, steel strips for securing rafters and timber for pegs, profiles, etc.				202.00

Labour requirements

Skilled labour	Day	13	25.00	325.00
Unskilled labour	Day	10	15.00	150.00
				2697.00



(a) rear view



(b) plan view with drophole and pit in use marked with a cross

Client
RWSG , UNDP / World Bank

Project
RWS & S Anambra State , Nigeria

Description
Domestic alternating-pit VIP latrine

Drawn
HvD

Figure number
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Approved
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Date
04-'89

Drawing number
1805-.

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The following materials are required for a UNICEF specified multi-compartment alternating VIP-latrine:

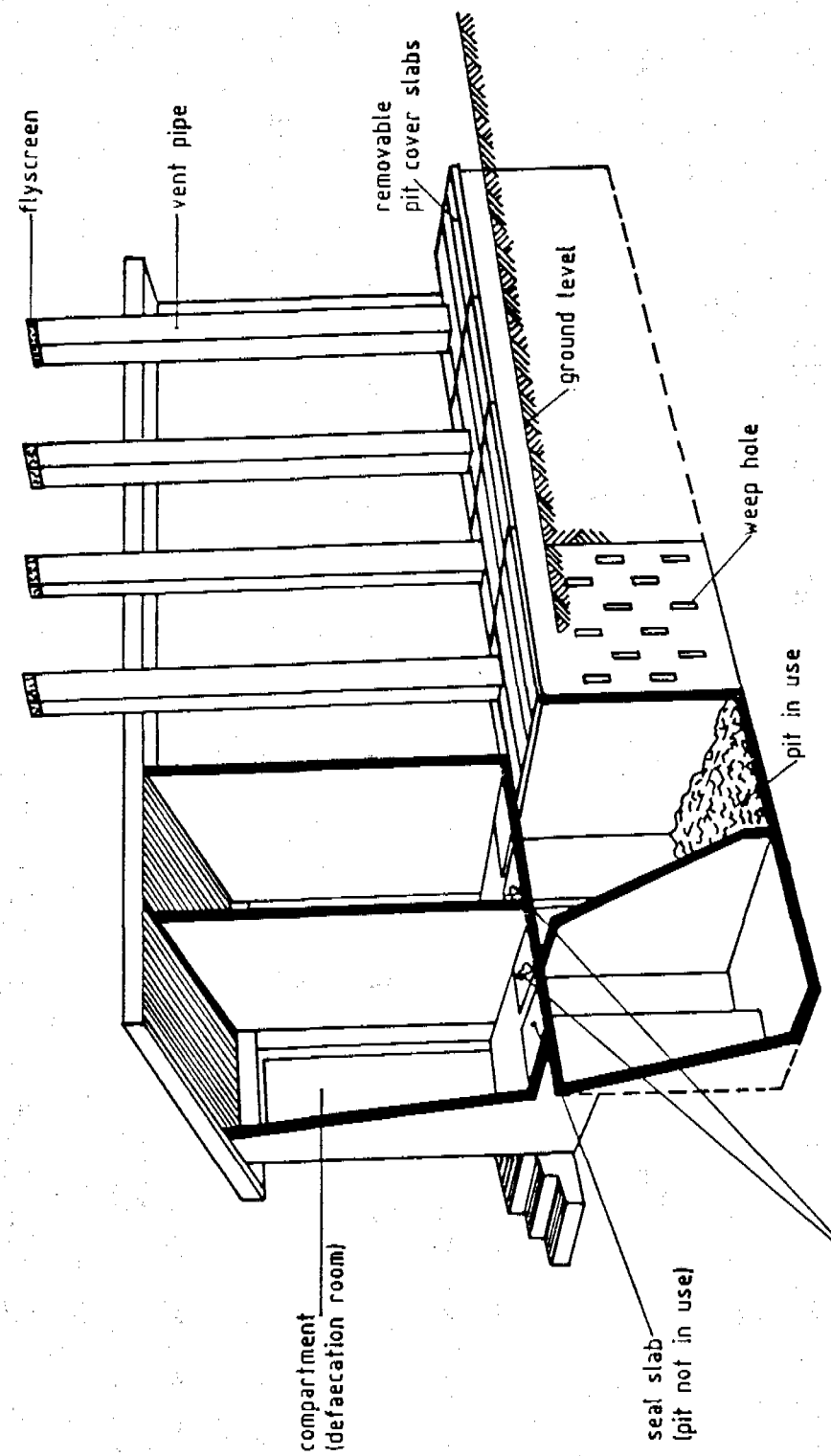
Material	Unit	Quantity	Rate	Amount
		5 comp.		
9in x 9in x 18in blocks (vent pipe included)	No.	520	2.50	1300.00
6in x 9in x 18in blocks	No.	260	2.50	650.00
4in x 9in x 18in blocks	No.	350	2.50	875.00
Cement	bag	85	43.00	3655.00
Sand - sharp and smooth	cu.yd	20	25.00	500.00
Aggregate (3/8 - 3/4in)	cu.yd	5	25.00	125.00
Steel reinforcing bars (30ft x 3/8in dia)	No.	25	40.00	1000.00
Formwork				
3in x 2in x 12ft softwood for precast slabs	no.	29	10.00	290.00
6in x 1in x 12ft softwood for foundation and insitu slab	No.	12	10.00	120.00
Roof timbers				
4in x 2in x 12ft softwood for rafters	No.	3	14.00	42.00
3in x 2in x 12ft softwood for purlins	No.	6	10.00	60.00
6in x 1in x 12ft planed softwood for fascia board	No.	5	12.00	60.00
6in x 1in x 12ft hardwood	No.	2	18.00	36.00
Nails (assorted incl. roofing)	lb.wt.	20	10.00	200.00
Aluminium or stainless steel mosquito-proof netting	sq.ft.	6	2.00	12.00
Corrugated iron, asbestos or aluminium sheets (6ft x 2ft 3in)	No.	12	25.00	300.00
Hinges with screws	pairs	5	8.00	40.00
Padlock staples with screws	No.	5	8.00	40.00
Barrel bolts with screws	No.	10	7.00	70.00
Doors complete with frames	No.	5	60.00	300.00
Emulsion paint	gal.	6	30.00	180.00
Gloss paint	gal.	2	80.00	160.00
Solignum-type wood preservative	gal.	1	30.00	30.00
				10045.00
Allow 10% additional cost for water, binding wire, steel strips for securing rafters, and timber for pegs, profiles, scaffolding etc.				1004.00
Labour requirements				
Skilled labour	Day	72	25.00	1800.00
Unskilled labour	Day	96	15.00	1440.00
				14289.00

Summary of costs of various latrine options

Latrine type and description	Located in stable soil condition		Located in instable soil condition	
	Naira	US $	Naira	US $
1. Mozambique type to slab level only, excluding cost of unskilled labour.	84	11	332	45
2. Mozambique type to slab level only but with block vent pipe, excluding cost of unskilled labour.	145	20	393	53
3. VIP latrine to slab level only excluding cost of unskilled labour (UNICEF design)	388	52	786	106
4. Alternating VIP latrine to slab level only, excluding cost of unskilled labour (UNICEF design)	1814	245	1814	245
5. Ditto including block superstructure	2547	344	2547	344
6. Ditto including 5 compartment block superstructure and 6 compartments substructure	12849	1736	12849	1736

Note: US $ 1.00 = N 7,4 mid February 1989.

Annex 8.4



Client
RWSG , UNDP / World Bank

Project
RWS & S Anambra State , Nigeria

Drawn
HvD

Figure number
.

Approved
.

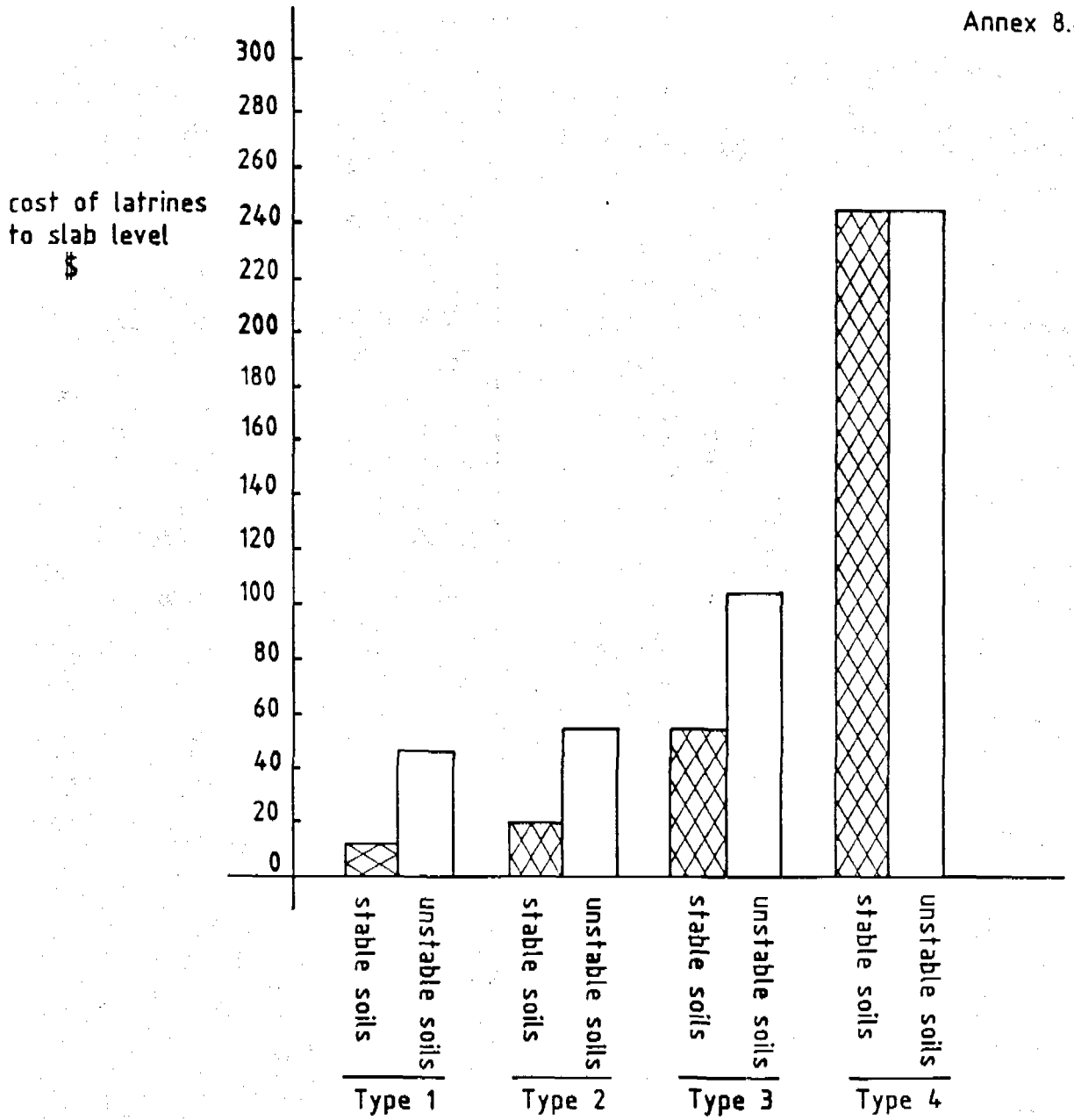
Date
04-'89

Description
Five compartment alternating VIP latrine

Drawing number
1805-.

IWACO
Consultants for Water & Environment
P.O. Box 183, 3000 AD Rotterdam
Schiekade 189, Rotterdam
Telephone (010) 4.241.641
The Netherlands

Annex 8.4



Type 1 : Moçambique type to slab level only, excluding cost of unskilled labour.

Type 2 : Moçambique type to slab level only but with block vent pipe and excluding cost of unskilled labour.

Type 3 : VIP latrine to slab level only, excluding cost of unskilled labour (UNICEF-design)

Type 4 : Alternating VIP latrine to slab level only, excluding cost of unskilled labour (UNICEF-design)

Note : US $ 1.00 = N 7.4 (mid. February 1989)

Opdrachtgever
RWSG , UNDP / World Bank

Project
RWS & S Anambra State , Nigeria

Getekend
HvD

Figuurnummer
.

Gezien
.

Datum
04-'89

Omschrijving
Cost of various latrine

Tekeningnummer
1805-.

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Aerial photographs.

ANNEX 10.1: AERIAL PHOTOGRAPHS

Maps and statistics are basic data for any planning purpose. The availability of up to date material of Anambra State is poor. The most recent aerial photographs data from the early sixties, and so do the topographic maps based upon these photos. The last officially recognized census is the zone of 1963. Projections are made from it, assuming an annual growth rate of 2.5% for the rural areas and 5% for the urban areas. Variations of these growth rate figures can be immense so it is not known how many people live in the state and how they are distributed.

At the same time an immense development of infrastructure happened throughout the state that had as well its influence on settlement.

Planning of development can only be done if the target group is well identified. Recent aerial photographs are of great help to do so.

Photos should be taken with about the following specifications:

Scale:1:50.000
Overlap in flight direction:60% for stereoscopic view
Side overlap:20%

Depending on other materials available (e.g. satellite images) the elaboration can range from simple village maps to detailed topographic maps for the whole area. A combination of aerial photographs with satellite images seems to be most effective. The satellite images (e.g. Landsat-Thematic mapper) can serve to print new topographic maps on a scale of 1:100.000. The aerial photographs then can be used for detailed studies in their original format of enlarged. Among those detailed studies are:

- hydrogeological survey;
- demographic estimates;
- design of reticulation systems.

The costs to cover the three selected LGA's Igbo-Eze, Anambra and Ikwo by about 250 aerial photographs would be about 27,000 US $. A coverage of the whole state would take about 2000 photos and cost approximately 130.000 US $. These amounts include costs of mobilization and prints.

Satellite images.

ANNEX 10.2: SATELLITE IMAGES: LANDSAT THEMATIC MAPPER IMAGE MAPS

1. INTRODUCTION

Satellite images can be used as a cost effective means to obtain reliable and up-to-date information on human activities in Anambra State. In view of the size of the area and the required scale of the image maps, Landsat Thematic Mapper (TM) imagery is the optimum data source. Using the right combination of spectral bands and applying a proper enhancement procedure image maps can be produced at a scale of 1:100,000 showing clearly outlines of human settlements, agricultural activities and infrastructure.

2. PROCEDURE

The production of satellite image maps consists of the following four steps:

Selection and purchase of digital data:
From the Landsat 4 and 5 Reference Map the proper scenes can be selected. A computer search can be conducted by EOSAT, the supplier of Landsat products, to list available scenes with their cloud cover and image quality. From quick-look prints the best images will be selected and ordered.

Geometric correction:
Using existing topographic map sheets of scale 1:250,000 and, wherever available, on a larger scale, the digital images will be geometrically corrected. Through proper selection of ground reference points the TM images will be resampled and mosaiced to fit the topographic map sheets.

Image enhancement:
In the literature bands 1, 4 and 5, or bands 3, 4 and 5 are generally presented as the combination that contains most of the spectral information in vegetated areas. Moreover, presenting band 4 in the green channel gives a "near natural" look to the image.
Applying edge enhancement filtering and piecewise contrast stretching the separate bands will be interactively enhanced to emphasize human settlements in the area.

Film plotting and printing:
Simple cartographic information such as names of major towns and a coordinate grid will be added to the image. Plotting of the printing films should be done on "real map size" to avoid deformation in the map corners. Printing of the complete area will be done on map sheets at a scale of 1:100,000. The sheets will be 80 x 75 cm^2 in size, the actual image will be 70 x 75 cm^2.

3. COST

The cost involved consists of imagery, image processing, and printing of image maps. Depending on the actual location of the TM scenes the total cost of the imagery will be $ 10,800 or $ 9,000.

Landsat TM CCT:	$ 9,000	to	$ 10,800
Image Processing (incl.: cartography)			$ 21,000
Plotting and printing			$ 9,000
Total	$ 39,000	to	$ 40,800

+ 1 man-week remote sensing specialist for:
- selection, ordering tapes;
- supervise processing.

SPOT panchromatic (B&W) for 3 pilot Local Government Areas:

* Each of the LGA seems to fit exactly in a SPOT scene (see SPOT reference map);
* SPOT PAN images have ground resolution of 10 x 10 m^2

Name LGA K-J (reference map)
Anambra 74 - 337
Igbo-Eze75 - 336
Ikwe 76 - 338

* Computer search of available images can be done by SPOT Image in Toulouse, France.
* Costs:
3 PAN CCT's (à $ 2,300)$ 6,900
Image processing$ 6,000

Option 1:
Printing on scale 1:50,000 (3 maps) $ 2,700
Total 1$ 15,600

Option 2:
Printing on scale 1:25,000 (12 maps) $ 4,000
given the size of 25x25 km^2 of each pilot area
Total 2$ 16,900

+1 man-week remote sensing specialist (ordering tapes, supervise processing).

Image processing includes:
- geometric correction; resampling; to a pixel size of 5 x 5 m;
- edge enhancement filter;
- contrast stretch.

Guidelines for identification of target group.

ANNEX 10.3: Guidelines for identification of target group (part of baseline survey)

1. The baseline study should be done per LGA.

2. Establish up to date maps of target areas on 1:100.000 scale or more detailed. This can be done on the basis of satellite images (see annex 10.1) or aerial photos (see annex 10.1).

3. Get information of the Local Government of the LGA under consideration that the community list of the Ministry of Local Government, Rural Development and Chieftaincy Matter (1985) is correct.

4. Establish list of villages per community.

5. Locate the villages on the map, with help of local rulers. Where villages merge trace their boundaries by field reconnaissance.

6. Make estimates of the population of each of the villages. This could be done by visual classification of the territory of the village in settlement densities, and determine their surface areas. The different classes of settlement densities must be sampled on the field. On enlarged aerial photographs the number of houses per unit area can be determined; in the field the average size of a family that occupies one house can be determined by inquiry. This must lead to a number of inhabitants per square kilometer for each of the distinguished classes of settlement density.

   It must be stated that this approach does not give the precise results of an official census but the procedure is far less complicated and less politically sensible.

7. For point number four hereabove most communities and villages must be visited. It is useful to set up at the same occasion an inquiry about actual water supply and sanitation practices.

8. For a proper statewise planning of development of rural water supply and sanitation it is necessary to do such baseline surveys in each of the LGA's. This baseline survey can support then many more planning activities.

Guidelines for technical activities.

ANNEX 10.4.1: Guidelines for source selection

The first rough selection of sources to be selected for development should be done on the basis of the hydrogeological zoning. Within a zone a number of factors must be considered such as:

- the service level required: what does the target population desire and what do they have now? (actual recurrent costs, distance to waterpoint, water quality, reliability);
- ability and willingness to pay for water;
- size and density of the target population.

Once these factors have been assessed the number of alternatives will drop as well, as not many alternatives meet the demand. If any alternative options stay available a choice should be based upon:

- maximization of community involvement;
- minimization of recurrent costs.

This means that hand-dug wells will have preference over boreholes, provided that the local conditions are such that there are good chances to construct a good well.

ANNEX 10.4.2: Guidelines for well siting

For well siting there are always two major influencing factors:

- preferences of the target group;
- technical factors.

The more people are directly involved in water collection at the waterpoint the more their preferences have to be taken into account. A hand-dug well for instance should be sited within the area preferred by the villagers, while a system consisting deep borehole with reticulation can be sited almost everywhere from social point of view.

The guideline thereafter concern only the technical factors.

Hand-dug wells and boreholes in the shale areas:

Wells preferably sited in fractured zones or, in zones under influence of dolorite intrusions or dikes. It has to be found out if such features act as aquifers or as aquitards. In the first case the waterpoints have to be sited within the intrusive rock zone, in the latter case just upstream of it. Aerial photographs are of great help to identify favourable zones. The UNICEF financed WATSAN projects does not have them available but has nevertheless good results during their first month of operation.

The WATSAN project only uses geophysical methods: geophysical profiling to track the fractured zones, geophysical soundings, to determine the succession of soil layers and/or the depth of the watertable. Shallow hand-dug wells and boreholes should be sited anyway on the less elevated grounds, as the depressions tend to coincide with the fractured and so draining areas where most groundwater flow to. Precaution should be given not to site the wells in areas liable to be flooded.

A negative well makes the villagers loose their confidence in the technique so it will be difficult to mobilize them for another attempt.
In order to avoid abortive hand-dug wells a testhole should be drilled prior to construction. For this purpose a light rig like the "Portable Minutemen" of "Mobile Drill" is useful, but hand operated installation exist as well. An auger hole gives useful information to the occurrence of impermeable rocks and the depth of the watertable. As the hand-dug wells will in many cases be constructed by the villagers it is important to avoid sites where no properly yielding wells can be made.

Deep boreholes in sandstones

As the sandstones are almost horizontally layered no precise well siting is necessary. The landscape in the sandstone area shows quite a relief that is almost not followed by the watertable so the lower zones have preference for deep boreholes in order to reduce the depth to be drilled. However it may be more profitable to drill a deeper well and reduce the transport length of the transport mains.

In order to optimize the performance of the well and the pump and minimize energy consumption it is essential to pay attention to the well construction, development and to execute a pumptest before ordering a submergible pump.

Spring captation

The possibilities for spring development will be limited compared to the total needs. In many cases springs will already be exploited and some upgrading improves easiness of water collection, storage and to the water quality. As people tend to settle where good water is available it is unlikely that unexploited good wells will be found at short distance of a village, but a check of aerial photographs is useful to make sure that no suitable springs are overlooked.

When the development of a spring is considered it is important to assess the minimum yield. This can be done by querying the population but rather by observation by qualified personnel at the end of the dry season.

Impounded reservoirs on shales

The impounded reservoirs are actually found in the Eastern part of the State, which is underlain by shales. Only in this part infiltration is sufficiently restructed by the almost impervious subsoil. The reservoirs are filled up by rain, so no surface runoff is led into the reservoir, with two main advantages: (i) the water in the reservoir does not carry a high silt load, like surface water does, nor other pollution collected during its flow into the reservoir and (ii) the risk that the reservoir is destroyed by a peak runoff greater than the design capacity of the spillway is minimal.

The reservoir should be located at sites where the subsoil is most impervious. As the area is mainly underlain by shales this does not seriously limit the sites. It is recommended to do a simple infiltration test prior to construction.

ANNEX 10.4.3: Guidelines for detailed design

The following points can be taken into account for detailed design:

1)	Design period:	10 years
2)	Design population:	to be determined by baseline survey.
3)	Annual population growth rate:	2,5%
4)	Specific consumption:	20 l/cap/day
5)	Peak demand:	2 times average daily demand
6)	Normal pumping day:	8 hours
7)	Maximum pumping day:	12 hours
8)	Storage:	To be determined by peak demand or 0,5 days consumption.
9)	Source selection:	1) Groundwater rather then surface water. 2) Least cost solution.
10)	Flow sand filter:	
	Filtration rate:	1 m/h
	Minimal thickness of filtration bed:	0,5 m.

ANNEX 10.4.4: Guidelines for the Supervision of pipe laying

All pipes and joints must have manufacturers classification irremovably marked on them. Any that do not must be rejected, marked for identification and taken off site.

Pipes must be laid in straight lines, all joints must be properly fitted and sealing rings properly located.

Pipes must be laid on a suitable granular or sand bed and fully supported to prevent any unnecessary local stress being created during or after backfilling.

At all change of pipe direction, suitable trust or anchor blocks conforming to manufacturers recommendations must be placed.

Suitable depth of cover to the pipes must be maintained at all times in accordance to manufacturers recommendations. Suitable protection must be given in all cases where less than minimum unprotected depth or where additional heavy loading will occur such protection must again conform to manufacturer's recommendations.

Suitable ensily identifiable marker posts must be located at convenient distances along the length of the pipeline and all all change of direction.

Fully detailed as constructed drawings of the pipeline giving its location and depth together with measurements from permanent objects or structures must be prepared during construction.

Organization of operation and maintenance.

ANNEX 4.3: OPERATION AND MAINTENANCE

Introduction

For the strategic plan a limited set of alternatives for water supply facilities is proposed. All these schemes are to be operated and maintained, as much as possible by the villagers themselves. In the discussion below, for a description and division of responsibilities a difference is made for operation, technical maintenance, hygienic maintenance and financial maintenance. Only in one case supervision of the whole facility is mentioned seperately. In other cases it is assumed a village-based consumers committee will be in charge of overall supervision and coordination.

This Village Water Association (VWA) is a conmsumers organisation of which all the adult users of the water supply facility are a member. The general assembly of the VWA elects an executive board. This board represents the consumers in daily matters concerning the water supply system. The executive board is to consist of at least a chairman and a treasurer but may have more members. Women should make up 50 % of the board.

Central in day-to-day caretaking and supervision are the Village Caretakers, nominated by the Village Water Association. These caretakers will be responsible for preventive maintenance, minor repairs and hygienic maintenance. Preferably women, but at least one women are to be appointed as VPC. The caretakers are to be trained by the project and/or LGA staff and provided with the necessary tools. After training and pump installation a contract is made up between the VPC and the Village Water Association. The caretakers are responsible for a set of duties, in return they will receive a renumeration in cash or kind which was decided and agreed upon decided during the pre-construction phase of the projects. Selection and nomination of caretakers should be based on: ability to read and write, be a permanent resident of the village and active member of the community, willingness to join training.

The ownership of the scheme is to be determined prior to construction. Possible alternatives are:
- the village or community (embodied by the VWA)
- private sector
- Local Government
- Anambra State Water Corporation.

Preferably the users of the system should be the owners of the facility, provided they constitute a VWA. It is urgently recommended that any transfer of ownership will need the approval of both the Local Government and the State Department for Rural Development.

Hand dug wells and shallow boreholes with handpumps

It is recommended to equip hand dug wells with a handpump for hygienic purposes. One handpump will serve up to 300 people; in case more people are to benifit from the same hand dug well, more than one handpump (or more than one hand dug well) can be considered. On completion of the construction, the well and the pump(s) are owned by the villagers.

Operation
Operation is done by the users of the facility. (Some training/education/information is to be provided by the caretakers on proper operation, proper use of water and hygienic practices in the surroundings of the facility.)

Technical Maintenance
Regular preventive maintenance and minor repairs are dealth with by two Village Pump Caretakers (VPC).
Non-routine maintenance and repairs beyond the capacity of the two technical will be executed by staff of the Works Department of the LGA. Village caretakers will assist LGA staff during repair activities.
These staff (2-3) will be trained by the project and are to be provided with the necessary tools.

Hygienic Maintenance
The VPCs are responsible for hygienic maintenance as well. Hygienic maintenance consists of well area sanitation (keeping the environment of the water point clean and maintaining hygienic practices), training of users to operate their facility and providing informatio on proper use and storage of water.
Since hygienic maintenance is a daily activity and facility users connected, preference for female caretakers is obvious.

Financial Maintenance
In order to provide the necessary funds for (mainly) maintenance and caretaker-renumeration, the village water association should decide which system of contributions and treasuring will be used. From the financial point of view it is recommended to have any time sufficient funds for the most expensive repair and to collect these funds regularly (and not as a result of breakdown). However, the villagers might prefer a system in which funds are only collected in the event of a breakdown. A system with monthly or annual contribution for operation and minor maintenance combined with ad-hoc contributions through fund-raising in case of breakdowns, major repairs and replacements could be the most appropriate one.

The board will be responsible for collection of funds and treasuring these. Disbursements will only be allowed with the approval and signatures of both chairman and treasurer of the village water association.

Spring captations

Operation
Completely the same as hand dug wells (see above).

Technical Maintenance
Daily technical maintenance of spring captations is virtually non-existing. Other maintenance (repairs and upgrading the facilities) will be arranged according the situation. The village water association is to organise this.

Hygienic Maintenance
Village Spring Caretakers will be responsible; the contents is the same as for hand dug wells (see above)

Financial Maintenance
For daily operation and maintenance, hardly no funds will be necessary (except for cleaning and/or salaries).

Catchment ponds equipped with slow sand filtration

Operation
Operation is limited to the handpumps and can therefore be done by those consumerse who fetch water.

Technical Maintenance
Periodically (once every month to every year, depending on the system) the sand filter system will need cleaning and/or replacement of sand.

For these activities only supervision by trained staff, e.g. LGA staff, is necessary. Villagers can provide materials and direct labour. The VWA is responsible for organisation of materials, tools, equipment and labour.

Hygienic Maintenance
Hygienic maintenance is basically the same as mentioned under hand dug wells. Additional attention should be paid to protection of the pond from filth, human beings and animals (husbandry). The fence (constructed around the pond) should be kept in proper condition.

Financial Maintenance
The same as hand dug wells (see above).

Motorized boreholes

This alternative consists of a deep borehole, submersible pump, an overhead storage tank and limited reticulation (standpipes only). Depending on the availability of electrical power, a NEPA connection or a genset will power the system.

As will be described below, the total number of staff depends on the technical complexity, the revenue collection system and the number hours of operation (shifts). However, the minimum is two full-time staff. Staff for a mechanized borehole system should preferably be recruited from the community served by the system. In principal, women can be recruited for the jobs as well as men.

In case a borehole systems is equipped with standpipes ("public taps"), these standpipes will need a way of caretaking, at least hygienic maintenance. Caretakers, sometimes the same as operator, will need to be appointed for each standpipe.

Depending on the choosen system of revenue collection, in case of cash-on-delivery a caretaker -preferably female- per standpipe will be necessary. Proper arrangements on the revenue collection and especially rights (a.o. renumeration) and duties of caretakers versus owner of the system have to be arranged prior to operation.

Operation
Besides operation of pumps and other equipment, operation of the scheme consists of monitoring and checking pressures, yield and quality of water. A one-shift operation (8 hours a day) will need either one or two operators on the spot: In case of a connection to the national electrification network, only one trained operator will be required. In the situations in which a genset will power the system, two trained operators will be required.

The operators will have a full-time job; therefore a labour contract with the owner and payment of a salary needs to be arranged.

Technical Maintenance
Daily technical maintenance and usually minor repairs too will be carried out by the operators. Depending on the choosen organisational setup, major repairs and maintenance will be carried out by a backup organisation, such as the Anambra State Water Corporation, a contractor etc.

Hygienic Maintenance
As the operators are already on-the-spot, the majority of activities can be carried out by them. At the various standpipes, the caretaker (or operator) will be

in charge. Despite this, it is recommended to involve the benificiairies in the hygienic maintenance too (by means of (being) caretaker or standpipe committees).

Financial Maintenance
Financial maintenance consists of revenue collection and treasuring. As this type of scheme is a relative high-cost facility (high recurrent costs, is operation and maintenance), financial sustainability is essential. Determination of the revenue collection system should already happen in the decision making stage of a site-project. Depending on the choosen revenue collection system, the supervisor or the caretaker(s) will be in charge of revenue collection and treasuring. Overall responsibility for finance will be in the hands of the owner or exploitant of the system.

Supervision
Because of the complexity (mainly technical, sometimes financial/administrative too) of this type of scheme, a supervisor will be required. This job requires a well-trained technician. Assistance in these tasks may be provided from other agencies, e.g. local government.

Guidelines for distribution of spareparts.

ANNEX 10.6:ORGANISATIONAL SET-UP FOR SPARE PARTS DISTRIBUTION

Basically, there are two different organisational setups. Which setup will be applicable depends on the type of system: handpums or mechanized systems.

A. Spare parts for handpumps

For reasons of standarisation, the project will introduce one or a limited number of types of handpumps. Whenever possible, preference is given to Nigerian manufactured pumps and spareparts.

Initially, the project will provide handpumps and, during a limited starting period in a certain LGA, also spareparts.

One of the project objectives will to make spareparts available through the local governments.
In general, local governments are willing to take up responsibility for the distribution of spare parts and back-up for maintenance. Training of staff is necessary.

A proposal for the set up can look like as follows:

The local government establishes stock of most common sparepart (to be determined by local government and project staff).

Village pump caretakers (VPC) are informed on the logistical setup for spare parts distribution during their training.

VPC's receive regularly (twice a year) a list of spare parts which are available at or through the local government. The list states prices of each spare part.

These list of spare parts are prepared by the Local Government lists and are to be sent to and approved by the State Department for Rural Development prior to publication. This State Department checks whether the LGA provides the necessary spare parts and whether the prices are reasonable (that is: affordable and not that much difference between various LGA's).

In case of breakdown or replacement, the VPC determines the needed spare parts. He can seek advice from trained staff of the Works Department of the Local Government. Procurement from the LGA can be done by cash payment, proven by a receipt.

The Works Department is responsible for stockkeeping and additional purchases from suppliers or manufacturers.

In case of (temporarily) non-availability, staff of the Works Department is to seek a solution together with the VPC. The local government will need either a stock or a fund to commence her activities. This can be a (project) grant or a loan. In both cases however sound calculations on the price of spareaparts are needed which include: pay back of loan, inflation, overhead costs of LGA.

In principle, there are no objections when the private sector appears able and willing to take over activities of (parts of) the distribution system. However, monopolism on spare parts and thereby prices should be avoid.

B. Spare parts for mechanized systems.

Despite attempt to standardize, these systems will face more different choices for pumps, generator sets, electrical equipment, pipes and appurtunance. Also, far more than incase of handpumps this equipment has to be (partly) imported from abroad. Because of this and because of a fewer number of systems, a system of spare part stockkeeping and distribution by means of government channels does not look feasible. Certainly, availability of spare parts at LGA level is not feasible as this will need expertise and funds which are generally not available, also in the long run, in Local Governments.
Stockkeeping at state level does not have advantages over the private sector.
The private sector in Anambra State is relatively well developed regarding manufacturing, repair and trade of electro-mechanical equipment. (The area around Onitsha is famous all over Nigeria). Also, the effectiveness of the private sector is in many cases superior to that of the public sector.
By competion in the private sector there are better changes to come at least cost maintenance.

For these reasons, distribution of spare parts for mechanized systems will be completely dealt with by the private sector.
For the greater part the same is valid for non-regular maintenance and major repairs: as within the government system expertise and equipment is not always available and kept up to date, preference is given to specialized suppliers or contractors who can be hired in for these jobs.

Perhaps to some extend development of this industry and trade sector will need additional inputs, especially regarding small scale enterprises. However, it is assumed this can be dealt with in separate (sector) development programmes.

Some remarks:

1. For obvious reasons, whenever feasible preference should be given to local manufactured and available equipments and spare parts.

2. Owners of supply systems can directly approach suppliers of spare parts and reverse.