CONSTRAINTS TO EFFECTIVE EFFLUENT MANAGEMENT IN YOLA, ADAMAWA STATE, NIGERIA

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Abstract
This paper identifies the constraints to effective effluents management in Yola. The methodology adopted includes actual field measurements of drainage sizes, the determination of the functionality of the drainages and interviewing the stakeholders (providers and consumers) to ascertain management in place and field observation. A multi stage technique involving stratified random sampling technique was employed in the sampling of wards while systematic random sampling technique was applied in the administration of the questionnaire on 552 respondents. Descriptive statistical techniques such as the means and percentage were employed to analyze the data. The results revealed that the effluent disposal practices in the study area are inefficient and hence ineffective due to weak pollution policy instruments, dearth of sound master plan, lack of sewerage system, and in efficient and in effective infrastructure development, the rugged topography of the land, inadequate knowledge and information, jurisdictional complexity, weak institutional capacity, inadequate political will, insufficient regulatory policies, lack of effective public education and participation, inappropriate technology and poor funding. It is recommended that drainage systems plan needs to be prepared and integrated with a revised master plan and coordinated with roads, constriction, participation of multiple levels of government, community leaders, the private sector and professionals to be ensured, innovative financial mechanisms including the private sector involvement and public- public partnerships, etc.

Key wards: Effluent, Effectiveness, Topography, Constraint, Management

Introduction

Economic growth and population increase in developing countries have created high demand for sewerage and drainage infrastructure services that have far exceeded the provision of the services. While considering developmental activities, the assimilative and carrying capacities of land for pollution are rarely taken into cognizance. Also, lack of proper land use control brings about poor land use compatibility. As in Babu and Kumar (2004), the haphazard and uncontrolled developmental activities in cities can give rice to overuse congestion, incompatible land use and create high risk environment to city residents in form of deterioration of the natural and socio-economic living conditions which specifically include absence of properly designed and constructed drainages to evacuate effluent and sewage overcrowding, etc. In several urban centres in Nigeria, stormwater drainage channels are already sitted up as a result of lack of regular maintenance. Consequently, most roads are easily flooded even with a handful of rain (Oyebode, 1996). Open drains have become common sewerage facilities through which municipal effluents from domestic, institutional, commercial, and industrial sources are discharged untreated, as it is in Yola. These do not convey effluents into treatment plant where available for treatment before being

discharged into water bodies such as rivers, lakes ponds, streams or before use for other purposes like crop cultivation, etc, Furthermore, such open drainage system exists without sewerage network.

The objective of this study is to identify the constraints associated with effluents management in the study area.

The Study Area

Yola is a twin city constituted of Jimeta, and Yola town that form the capital of Adamawa State (Fig. 1) it is Located on latitudes $9^0$12N and Longitudes $12^0$29(RAHALT consulting, 1995). Jimeta and Yola jointly occupy a total land area of 6,213 square kilometers (Saidu, 2007) and has a total population of 392,854 people with the annual growth rate of 2.7% of National Population Commission, 2006). The study area has a tropical continental climate with marked rainy and dry seasons. The average rainfall for the area is about 957.9mm while the maximum and minimum temperatures are 34.5^0C and 21.2^0C, respectively, with a mean temperature of 27.9^0C (Bashir and Adebayo, 2002).

Yola lies along the Southern flanks of the River Benue Valley varying in elevation from 180 – 300m above sea level. Tt is made up of flat gentle undulating plains underlain by sandstone and Yolde formation.

The topography of the erea slopes towards the River Benue valley, particularly towards the Yola sub-basin and is consisted of extensive network of streams such as the Chouchi, Mayo-Inne, and Lumo, surrounding the broad sandy flood plain of the River Benue. To the Northeast of the study area is steep escarpment of 230meters above the River Benue bed with surface roughness which influences the velocity of erosion and pollution effects (Zemba, 2002).

Material and Methods

The study area was categorized into low, medium and high density residential areas. Stratified sampling technique was employed in the selection of wards. Basically, six (6) wards were selected randomly in such a way that two wards were selected by systematic random sampling from each stratum of the residential areas (namely, High, low and medium densities). The next stage of sampling was the selection of streets in the wards. Simple random sampling method was employed to select two streets from each ward by picking two from the balls of numbers representing the streets. This yielded a total of twelve (12) streets. This stage was followed by systematic selection of households after the first household had been picked randomly. To this end, every third (3^{rd}) household, beginning from the one picked randomly, was selected. In each selected household, the head of the household or an adult member (where he/she is absent) was administered a questionnaire. In all, 552 household heads were interviewed.

Furthermore, there were personal field observations on the condition of the open drains. This was to gain more insight into the management system and its effects on the physical and cultural environment. Descriptive statistical techniques involving means and percentages were employed to analyze the data.

Results and Discussion

Findings of the study revealed the constraints to effective effluent management to include:

Population

The study area is one with a high population growth rate of 2.7% per annum (N.P.C., 2006) and a corresponding increasing amount of effluents. This high population growth rate coupled with the accelerated rate of urbanization in the area is capable of straining the environment and outgrowth the city's ability to provide

effective drainage and sewerage services to the residents.

Topography of the Land

The topography of Yola divides it into parts sloping towards the River Benue. This topography is rugged with potentially erodible soils developed from coarse-grained granites and gneisses and fined-grained gneisses and schists. The removal of the protective vegetative covers for roads and buildings has precipitated serious erosion in some parts of the study area.

Planned Drainage Network

Yola lacks currently revised and sound urban development master plan incorporating environmental considerations into various development sectors (drainage channels, environment, housing, transport, industry, etc,) as the development control plans and the old master plan of 1976 and 1980 (figs.2 and 3), respectively, are still the ones being administered with little or no considerations for the necessity of structural changes in the area for long-term sustained development.

Basically, as revealed by the Director of the Planning Section of the Adamawa State Urban Planning and Development Authority, there exists no current master plan, let alone the one reflecting the objectives of environmental compatible development for the area. This, according to the Planning Authority for the area, is a result of funds diversion leading to lack of funds as well as the fact that it has not been a political priority to the successive administrations, in spite of the creation of the relevant Ministry of Environment by the recent last administration.

One problem of unplanned and uncontrolled development feature in Yola is the easement providing reserves needed for road expansion pedestrian walkways, drainage and utility infrasturucture in some locations in luggere Runde words, etc., were found occupied by permanent structures such as walls, building and petrol filling stations with containers and trailers houses for shops, stores, conteens, barbing saloons, etc. being make shift structures on theam

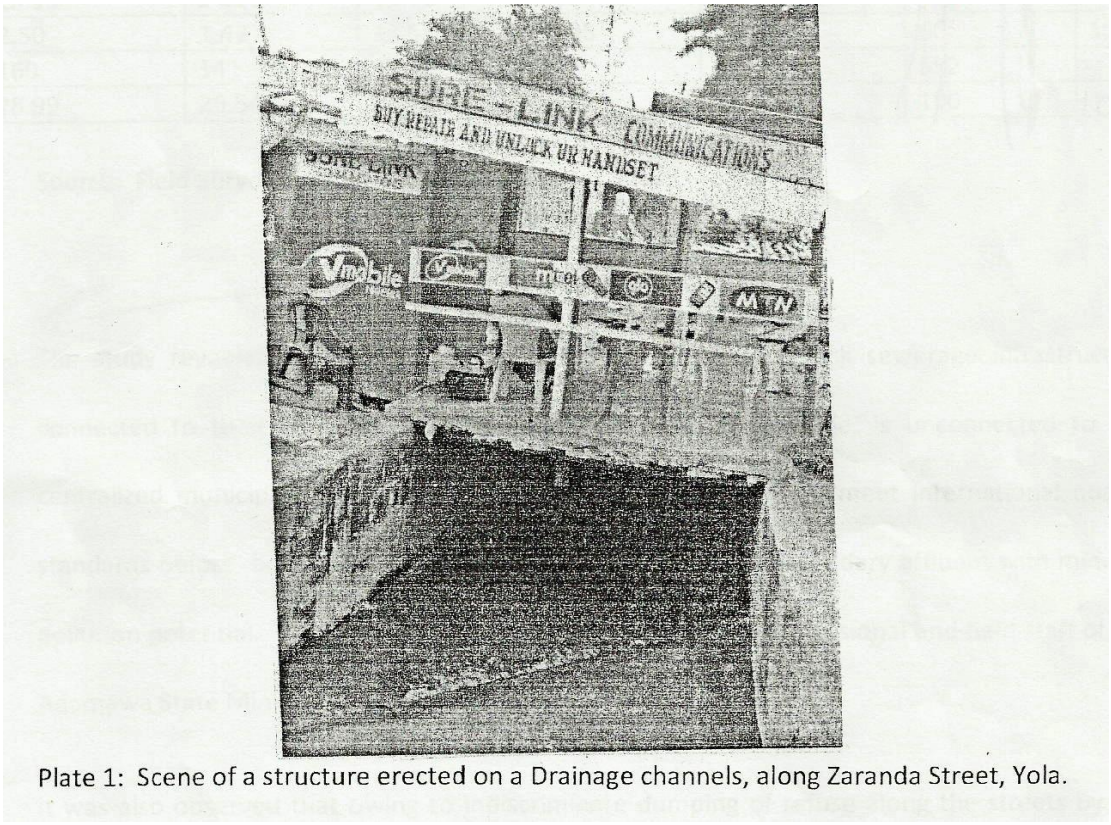

Plate 1: Scene of a structure erected on a Drainage channels, along Zaranda Street, Yola.

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Income Distribution

From Table 1, it can be observed that most of the respondents in the study area fall into the category of low income earners. Thus, poverty as revealed by the greater total proportion (about 55% of the residents belonging to the low income group (earning less than N7, 000.00 to N10, 000.00 per month) implying their inability to pay for civic services and general maintenance.

Table 1: Monthly Income of the Respondents (In percentage)

Less than 7000.00 (very Low Level income)	7001 to 10,000 (Low Level income)	10001 to 14,000 (Medium Level income)	14001 to 17,000 (High income level)	Above 17000 (Very high Level income)	percentage
27.50	31.31	13.19	6.82	13.06	21.56
30.00	27.66	16.48	10.23	25.00	23.37
4.38	3.55	32.97	40.91	20.83	16.85
23.13	24.11	13.19	5.68	16.67	18.12
2.50	1.42	13.68	32.95	11.11	10.87
160	141	91	88	72	
28.99	25.54	16.49	15.94	13.04	

Source: Field Survey, February, 2010

Connectivity

The study revealed that all the residents (100%) interviewed lack sewerage infrastructure connected to their houses. Similarly, the study area as a whole, is unconnected to any centralized municipal

sewerage system for effluent treatment to meet international quality standards before being discharged into the environment as a secondary effluent with minimal pollution potential. This view point was attested to by all the professional and field staff of the Adamawa State Ministry of Environment, Yola.

It was also observed that owing to indiscriminate dumping of refuse along the streets by the residents, the drains are blocked and silted up to impede the free flow of effluents in the channels.

Field observations and measurements of the total length of 16,420.66 meters out of which 3,406.82 meters (about 22%) was found to have collapsed, or sited up with sand. Such drains are narrow (between 520mm and 550mm wide) are narrow (between 310mm and 790mm deep) leveled up with the roads surfaces (Plate 2).

Effectiveness of the Drainage Network

The drainage network in Yola is characteristically rudimentary, unlined, inadequate, and non functional upon channel drains and stagnated pools of effluents. Owing to overload and lack of maintenance of infrastructure, specific sections experience sewer blockages (fig.2) on request basis. The drainage network in the area has no sewerage network and effluent is discharged directly into watercourses around. Therefore, the drainage network in this area is ineffective. Interview with the Director of Waste Management and Pollution Control in the Adamawa State Ministry of Environment, Yola revealed that the responsibility for the provision of public drainage infrastructure, its maintenance and management essentially lies with both the government and the general public, being the stakeholders, but that has not been the case due to laxity and weak enforcement of policies without appropriate penalties from relevant authorities. The seeming act of insincerity (lack of political will) on the part of the Ministry has been identified to be one fundamental factor working against the provision of effluent management services and infrastructure in Yola, and indeed Adamawa State as a whole.

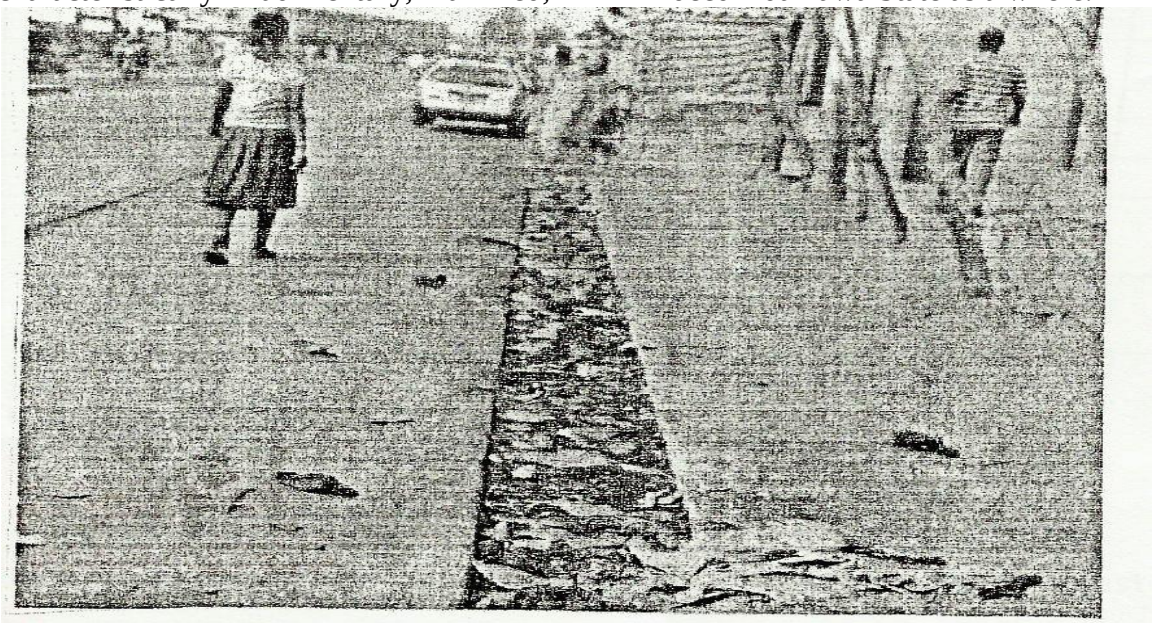

Plate.2: Blocked and silted Drains along Bishop Street

Responsibility for Effluent Drains Maintenance

Table 2 reveals that the vast majority of the respondents (63.22%) believe that the responsibility of handling the problem of effluent drains in the study area lies with the government; 7.25%feel that it is the responsibility of the non-governmental

organizations (NGOs), while, 5.25% perceive it is as a joint responsibility of the government and the Community as a whole. The result suggests little, or lack of public awareness and recognition on the importance of stakeholders' participation in the maintenance of effluent drains and the place of ideas, experience and expertise for development of alternative solutions

Table 2: Responsibility for Maintenance for Effluent Drains (in percentage)

Ward	Govt	Individual	NGOs	Govt/Community	Other	Total	%
Luggere	6.5	18.66	00	20.69	00	119	21.56
Runde	22.64	29.11	37.5	00	00	129	23.37
Demsawo	18.62	15.67	00	44.03	00	93	16.85
Makama	16.91	14.93	60	10.34	00	100	18.12
Karewa	4.3	19.4	2.5	6.67	00	60	10.87
Jambutu	8.88	2.24	00	10.34	00	51	9.24
Cumulative Total	349	134	40	29	00	552	
Cumulative Percentage	63.22	24.28	7.25	5.25	00	100	

Source Field Survey, February,2000

The study exists without any form of sewerage network and cannot boast of functional, adequate and effective drainage network which, according to Berry and Montgomery (2002) is a major contributor to pollution of watercourses and flooding risk, is grossly inadequate. The infrastructure which was adequate for the area with ever increasing population twenty-six years ago is today most inadequate. Drainage network design capacity and coverage were found to be inadequate - departure from the initial plan to cover the entire area with stormwater and adequate street side drainage infrastructure. Out of the seventeen stormwater drainage systems, only six (6) of them have been established. However, construction of drainage system requires comprehensiveness in the planning and development for environmental achievement (Adeyemo, 2002). Attempts to regard drainage network effluent treatment facilities and the receiving watercourses as one for the area are yet to be considered.

Basically, the findings of this study revealed that the current effluent management practices in the study area lack integrated approach that covers the various aspects of effluent management, generation, collection, removal, and disposal. This, in essence, implies inadequate environmental sanitation awareness and education resulting in appropriate attitudes of residents towards effluent management and disposal. Also, there is dispute between the Metropolitan Councils and the Adamawa state Government, regarding appropriate and sharing of responsibility and cost of effluent management in Yola.

Furthermore, there is weak institutional capacity characterized by lack of knowledge about effluent management and disposal by the relevant effluent management authorities. There is the constraint of unplanned and unmanaged urban growth in the study area leading to destruction of the natural resources environment. This is in addition to inadequate monitoring and enforcement of effluent disposal laws and regulations. Additionally, there is the situation of poverty as revealed by greater proportion (about 55%) of the residents belonging to the low income group lacking affordability

for civic services and general maintenance. Innovative financial mechanisms absence constitutes another constraint to effective effluent management in the study area.

Conclusion and Recommendations

The constraint of improper effluent management in Yola is multifaceted, therefore, for effective management of this to be achieved, a holistic and sustainable approach is desirable. Drainage systems plan needs to be prepared and integrated with a revised master plan and coordinated with road construction to prevent the current trend of haphazard development giving rise to blockage of drainage channels. The drainage network plan should include the lay out of both the existing new plans to be prepared bearing in mind other public utility designs so as to achieve environmental compatibility. Participation of multiple levels of government, community leaders, the private sector, and professionals from a variety of related disciplines in the planning and programme development process such as architects town planners, engineers, etc, to be ensured. Innovative financial mechanisms including the private sector involvement and public – public partnership. There should be effective use of a credit line for pollution control equipment and facilities and enforcement of sanctions such as negative productivity against polluters to cause them to use resources appropriately. Basically, fees for effluent services and public water based on the services having to cover their own investment capital and running costs. It is to be a self sustaining business. A myriad of mechanisms exist, however, to recover costs from the users of effluent service. These are:

a. Consumption – based charges levied upon discharges of the effluent need to be introduced. The volume of discharged effluent is directly related to consumption of portable water. In effect, the tariff is usually collected as a Sur-charge on the water consumption bill.
b. Effluent charges to be introduced to recover costs from the users of effluent services. The charges can be based on the actual quality and quantity of effluent on a fixed amount per household, or with regard to an industry on proxy based on verifiable information about the industry (production, number of employees, etc.)
c. Discharge permits or levies cap the incorporated for cost recovery purposes in Yola. The responsible effluent authorities need to set maximum limits on total allowable emissions of pollution to sewer, or to surface water. This system requires elaborate monitoring of effluent flow and quality. However, designing, enforcing cost recovery mechanism needs technical, institutional, legal, and financial arrangement for good monitoring system in regulations and legislations on receiving water quality level and emissions.

Local innovations cannot attain scale without cross - sectoral partnerships involving government business, nongovernmental organizations (NGOs), academics, media and the community in decision making process and implementation of effluent management project.

There is the need to create a favorable condition to experimentation, mutual learning and collaboration sustainable urban drainage system is desirable for the study area. This should have social justice, political participation, economic vitality and ecological regeneration only with all these social elements in place. Poverty alleviation schemes need to be evolved by improving the quality of air, water and having alternative locations to settle, ensuring food security by intensifying food crop production. This can be realized through local participation of the effected residents in the area. To

avert technologically induced effluent pollution environmental constraint, a research is required in the area of re-use and recycling of sewage and effluent on the environment, design and fabrication of pollution prevention equipment for treatment for effluent from domestic, commercial, industrial, and agricultural sources. This could be attained by the government establishing research development organization to pursue new effective, efficient and sustainable technologies, and by structuring tax laws. Finding of the various research and policy analysis activities are disseminated to urban networks, academic researchers, and relevant support agencies for their possible back –up for eventually.

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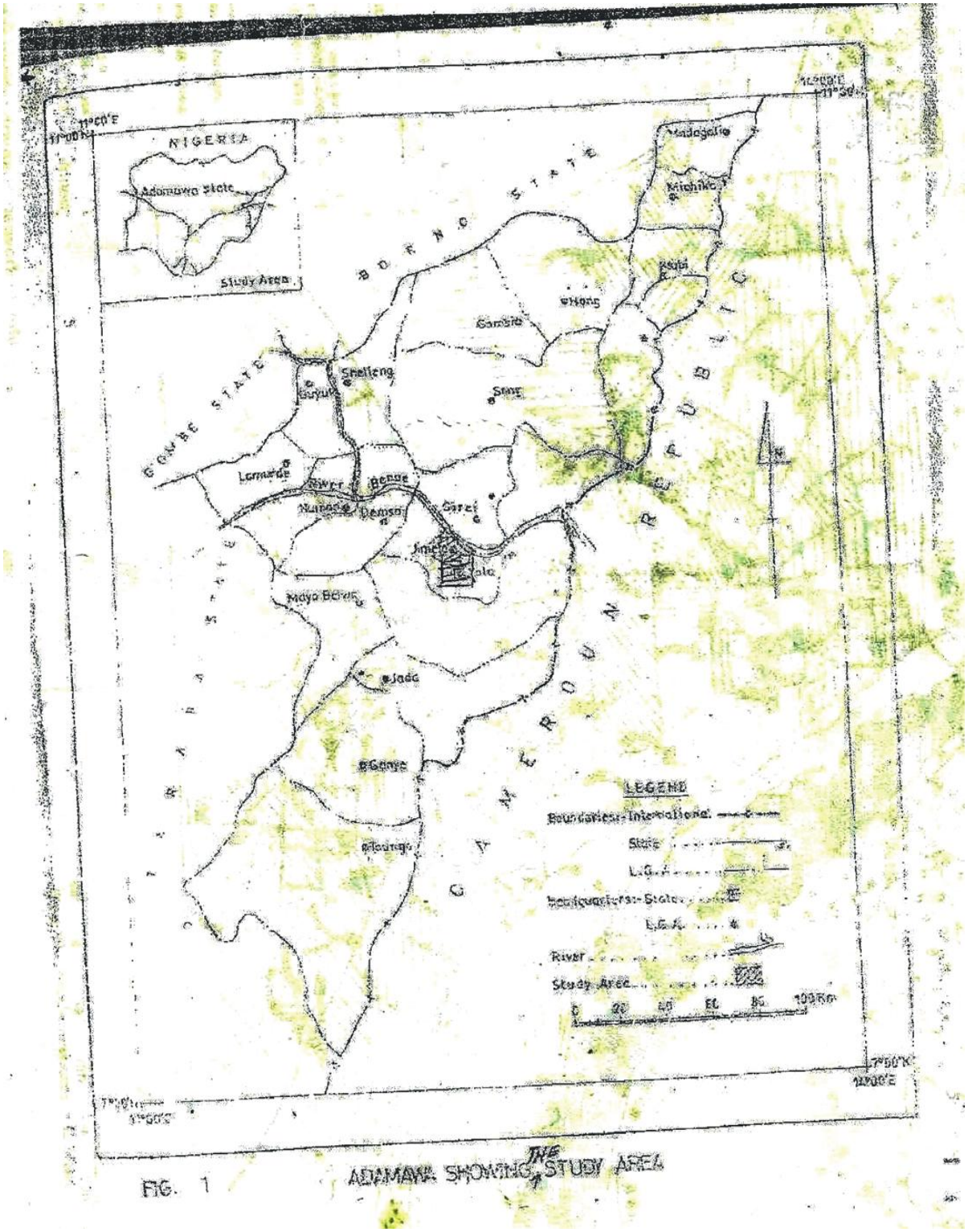

FIG. 1 ADAMAWA SHOWING THE STUDY AREA

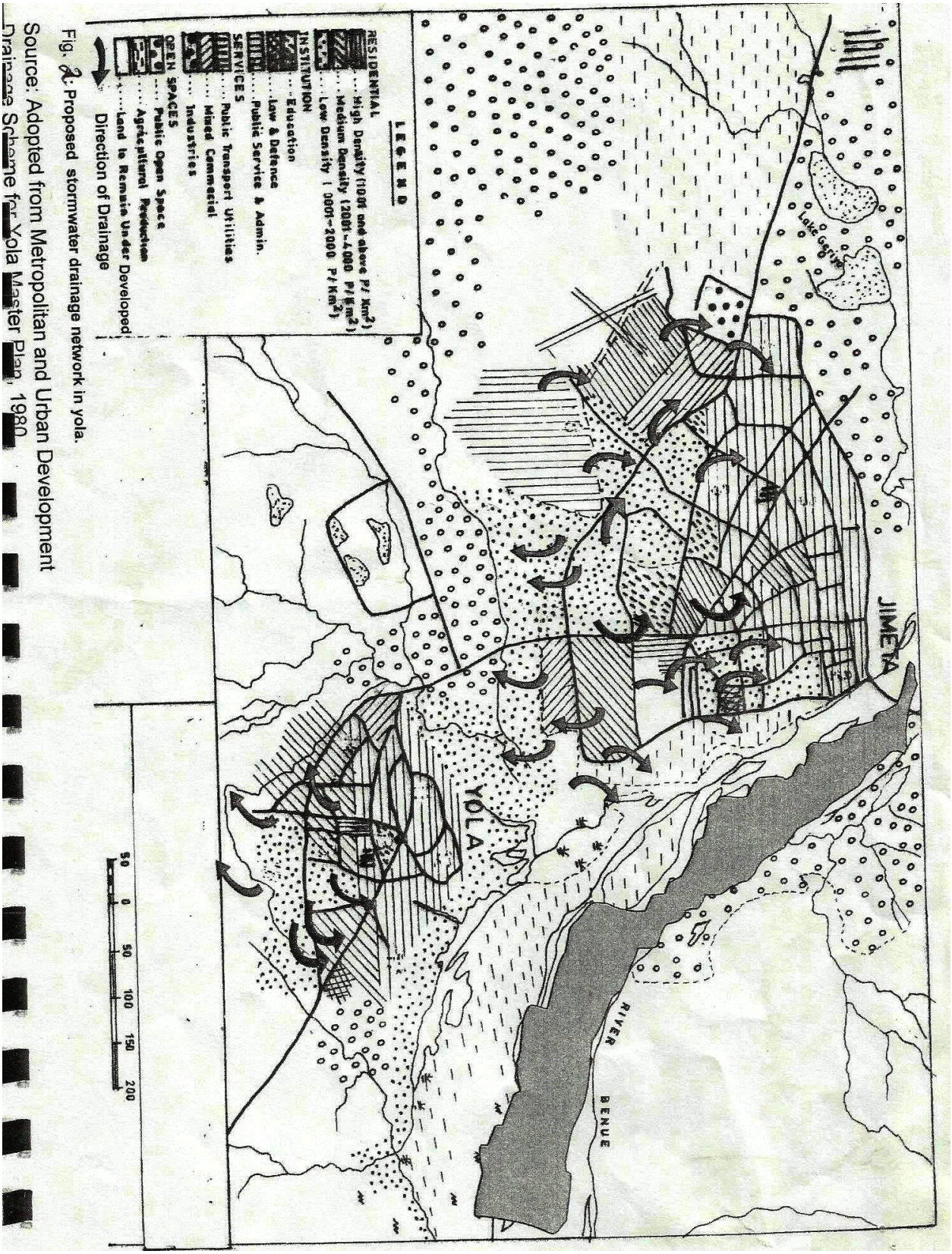

Fig. 2: Proposed stormwater drainage network in yola.

Source: Adopted from Metropolitan and Urban Development Drainage Scheme for Yola Master Plan, 1980

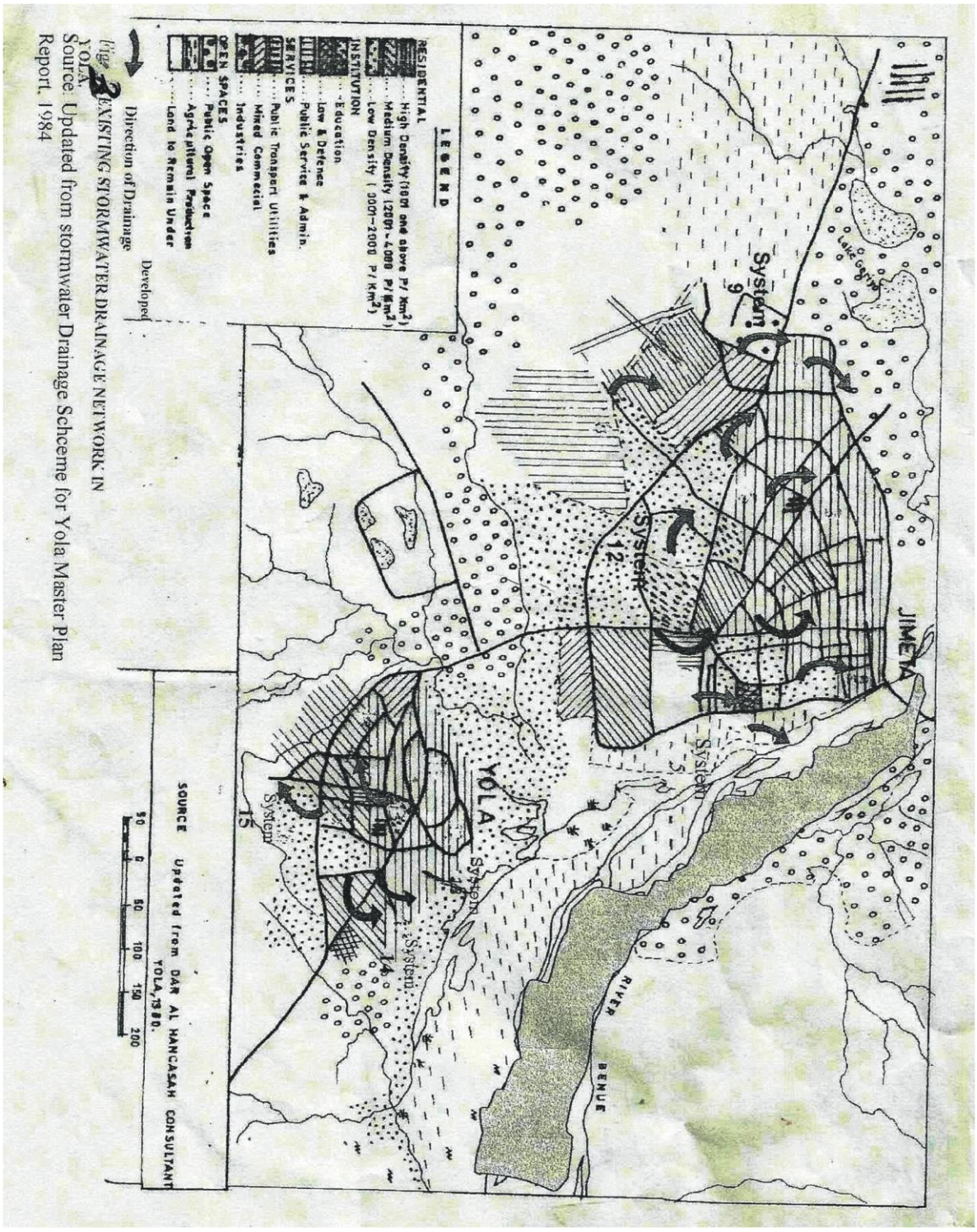

Fig. 2 EXISTING STORMWATER DRAINAGE NETWORK IN YOLA.
Source: Updated from stormwater Drainage Scheeme for Yola Master Plan Report, 1984