

ASSESSMENT OF URBAN DRAINAGE IN MAIDUGURI, URBAN AREA OF BORNO STATE, NIGERIA

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ABSTRACT

The study assesses challenges of drainage system in Maiduguri urban area of Borno State, Nigeria. The objectives of the study were to identify types of drainage, assess the changelings of poor drainage and examined public attitude toward drainage usage in the study area. Data were collected from both primary and secondary sources. Primary data were generated through filed observation and use of interview scheduled, while the secondary data was obtained from relevant literature. The survey had identified only one type of drainage in all the areas under study, drainage designed not standard, narrowed width and made in bricks. Findings revealed challenges of urban drainage, 32.5% of the respondents replied drains smell bad odor, 29.3% replied drains are breeding sites of vectors of diseases, 21.5% are opined that drains pollute environment while 16.8% replied drainage evacuation was not regular. Findings had also revealed public attitude toward drainage usage, 60.7% of the respondents replied toward they dumped refuse onto the drains channels. On the other hand the respondents gave reasons for their wrong attitude, 40.7% relied refuse dumping place was far away from their area, 28.9% opined that no refuse dumping place in their area, 17.8% opined that their houses were closer to drainage while 12.6% opined that they prepared to dumped refuse onto the drainage. The study revealed the back of waste collection and disposal system resulted in the area generation of larger volumes of waste and refuse in the drains.

Keywords: Drainage, Urban, Challenges, Stormwater, Runoffwater.

1. INTRODUCTION

For a long time, urban drainage systems have existed as a vital city infrastructure to collect and convey storm water and waste water away from urban areas despite development over the years it remains a significant challenge to design an effective functioning drainage system (Zhou, 2014). Urbanization represents other essential factors influencing the quantity and quality of urban water in cities. The process of city development can not only cause a significant in runoff patterns in terms of both peak flow volumes and speed of runoff due to its impacts on impervious surface (Huong and Pathirana, 2013), but also vulnerabilities to flood hazards due to change in urban intensity and distribution (Davies *et al.*, 2008).

Urban environments in Nigeria are face with myriad of issues regarding drainage systems (Offion *et al.*, 2008) and water tight structures which are the major causes of flooding (Belete, 2011). Urban flooding which is the inundation of land or property in a build environment particularly in more crowded areas are caused by rainfall overwhelming the capacity of drainage systems. Although this is sometimes caused by events such as flash flooding (Olukanni *et al.*, 2014). Urban drainage system issues are also generated by improper design of these systems. This is attributed to the variance created in rainfall distribution patterns faced by the developing countries as a result of global warming (Silveira, 2001). Most of these drainages were designed with basic hydraulic formula without considering this variance thereby ending up not solving flood cases in these areas.

Poor drainage systems in Maiduguri urban areas have caused tremendous environmental challenges. These challenges are basically associated with poor maintenance of drainage system and flood which eventually leads to environmental hazards. Some places were flooded, making the roads practically impassable for motorists. In many instances, torrential rainfall literally submerged the cities, halting human and vehicular activities thereby forcing residents to stay indoors as pre-emptive measure against human disaster. Therefore, the objectives of this study are to identify types of drainage, assess the challenges of poor urban drainage and examined public attitude toward drainage usage in Maiduguri urban areas.

2. MATERIAL AND METHODS

2.1 Study Area

Maiduguri is the capital of Borno State founded in 1907 by the British colonial masters for administrative purpose it has long been the largest and dominant city in the north eastern region of Nigeria. It lies in the Sudan-Sahel transition zone, located between latitude 11° 27' 30"N to 11° 33' 10"N and longitude 13° 2' 3"E and 13°9'10" E with a land mass of 550 square kilometers (Mayomi and Jimme, 2014). It is the headquarters of Maiduguri Metropolitan Council

bounded in the North by Jere LGA, in the west, south and south-West by Konduga local government area and 'm the north west by Mafa Local government.

2.2 Sampling and Data Collection

The study was conducted in April 2018 to August 2019 both primary and secondary sources of data were used. Primary data was generated through field observation and use of interview schedule. The secondary data were obtained from relevant literature. Field observation was carried out in five wards of Maiduguri urban areas under the study. Also a total of one hundred and twenty (120) interviewed was conducted in the five wards of; twenty four (24) respondents were interviewed from each ward. The wards are Bolori I, Hausari, Limanti, Bulabulin and Gwange III respectively.

2.3 Data Analysis

Data were analyzed by using descriptive statistics of frequency, percentage and tables to present the results. Statistical package for social science (SPSS) version 21 was used in analyzing the data.

3. RESULTS AND DISCUSSION

3.1 Socio-economic Characteristics of the respondents

The results of the socio-economic characteristics of the respondents recorded in (table 1) revealed out of 120 respondents interviewed 78.3% were male and 21.7% are females. In terms of their ages 24.2% of the respondents were between the age group of 20-30, 34.2% are between the age group of 31 – 40, 32.5% were in the age of group of 41 – 50, 7.5% are between the age group of 51-60 while 1.7% were between the age group of 61 and above respectively. Higher 29.2% of the respondents replied that they attended non-formal education, 6.7% said they attended adult education, those attended primary education were 11.7%, 26.7% replied that they had attended secondary education and 25.8% replied that they attended tertiary education respectively.

Table 1: Distribution of the Socio-economic Characteristics of the Respondents

Variable	Frequency	Percentage
Age group		
20 – 30	29	24.2
31 – 40	41	34.2
41 – 50	39	32.5

51 – 60	9	7.5
61 and above	2	1.7
Total	120	100%
Education level		
Non-formal	35	29.2
Adult education	8	6.7
Primary education	14	11.7
Secondary education	32	26.7
Tertiary education	31	25.8
Total	120	100%
Gender		
Male	94	78.3
Female	26	21.7
Total	120	100%

Source: Field survey, 2018 to 2019

3.2 Types Drainage Identified in the Study Area

The study had identified only one type of drainage open surface in all the areas under study, the designed are not standard in all the areas and narrowed width and make in bricks (table 2). Our field survey revealed that most of the drainages are related road drainage that is designed to shed water into roadside ditches. Such drainages are susceptible to cause erosion and ultimate results of which are the sedimentation problems in nearby water bodies, this was consistent with Pidwirny (2006). Open surface indicates there is more probability of pollution (air, water, soil) and public health risks associated with present drainage system this also consistent with Datta *et al.*, (2014). It was found that all the drains in the study area were constructed by using bricks and not concrete. But none of the drains were found have been constructed using either steel or any other materials as construction materials. Most of the drainage facilities in Maiduguri are not constructed using high quality and durable materials this also consistent Khan *et al.*,(2012;) and Tawhid, (2004). The present study revealed that majority of the drainages are not wide enough water overflow to the surface of roads during rainstorm causes flash flood as was consistent with Hossain *et al.*, (2013).

Table 2: Types of drainage identified in the study areas

Types	Wards	Made of Blocks
Open surface	In all areas	In all areas
Design are not standard	In all areas	In all areas
Narrowed width	In all areas	In all areas

Source: Field survey, 2018 to 2019



Figure 1: Open surface Drainage and Narrowed

3.3 Drainage Challenges in the Study Area

The study revealed challenges (table 3) 32.5% of the respondents replied drains smell bad odor. Poor drainage dissipate gas which is a complex mixture of toxic and nontoxic gases produced and collected in sewage systems by the decomposition of organic household or industrial wastes, typical components of sewage. Sewer gases may include hydrogen sulphide, ammonia, methane,

carbon dioxide, sulphur dioxide, and nitrogen oxides. Improper disposal of petroleum products such as gasoline and mineral spirits contribute to sewer gas hazards, as consistent with Alom and Khan (2014) and Datta *et al.*, (2017). 29.3% replied that drains are breeding sites of vectors of diseases (table 3), open drains carrying sewage or sullage water are potential sources of infection to children who play in them and leach pits provide breeding sites for mosquitoes and other vectors of disease, this also consistent with Parkinson (2002). Maiduguri urban areas experiences frequent incidence of malaria and cholera all year round due to stagnation sewage in the drainage this leads vulnerability to both adult and children.

Findings revealed 21.5% of the respondents opined that drains pollute environment (table 3) sewage and rainwater sewage and rainwater overflowed as a result of poor drainage maintenance. Urban runoff mixes with sewage from overflowed latrines and sewers can cause pollution and a wide range of problems associated with increased risk of waterborne diseases. Infiltration of polluted water into low-pressure water system can contaminate drinking water and it is the source gastro-intestinal disease, it was in consistent with Parkinson (2002). These poor drainages can creates faecally contaminated wet soil that are ideal conditions for the spread of parasitic worm infection such as hookworm and roundworm as consistent with Olukanni *et al.*, (2014). Drainage evacuation was not regularly carryout as replied by 16.8% (table 3), our survey revealed in most of the wards drainages were filled to capacity. Evacuation of drainage was sole responsibility of the state government which was done once in a year before raining season commences.

Table 3: Challenges of Drainage in the Study Area (n=120)

Challenges	Frequency	Percentage %
Smell bad odor	62	32.5
Breeding site of vectors of disease	56	29.3
Pollute the environment	41	21.5
Evacuation is not regular	32	16.8
Total	191	100

Source: Field survey, 2018 to 2019



Figure 2: Drainage overflowed with sewage

3.4 Public Attitude toward Drainage Usage

Survey revealed (table 4) 60.7% of the respondents replied they dumped refuse onto the drains and 39.3% replied they poured sand onto drains. Respondents gave reasons for their wrong attitude. Refuse dumping place was far away from their area replied by 40.7% of respondents and 28.9% replied no refuse dumping place in their area. The lack of waste collection and disposal system resulted in the generation of larger volumes of waste and refuse in the drains; this was consistent with Datta *et al.*, (2017). 17.8% replied gave reasons that their houses were closer to drainage, while 12.6% are opined that they prepared to dumped refuse onto the drainage. This indiscriminate attitude occurred as a result of abuse of drainage system is the most likely cause of drainage problems in all the area under study. The drainages that were constructed in these area lacked proper maintenance, as debris and waste materials were dumped into the drain thereby inhibiting flow of water in the drains, this was also consistent with Offion *et al.*, (2008).

Table 4: Public Attitude toward Drainage Usage (n=120)

Variable survey	Frequency	Percentage %
Dumping refuse into drainage	82	60.7
Pouring sand into drainage	53	39.3
Total	135	100%
Reasons for dumping refuse into drainage		
Refuse dumping place is faraway	55	40.7
No refuse dumping place in my area	39	28.9
My house is close to drainage	24	17.8
I prepare to dumped into the drainage	17	12.6
Total	135	100%

Source: Field survey 2018 to 2019



Figure 3: Drainage filled with refuse and sand

Survey revealed one of the main obstructions preventing the successful control of storm runoff measures either by structural or non-structural measures is the absence of community participation in providing solutions to urban drainage problems. Community participation simply depends on the desire and ability to organize themselves, strict compliance to societal goals and

rules, and providing medium of direct communication by the appropriate municipal administration.

4. CONCLUSIONS

The state of urban drainage is of great concern because of the health implication and environmental dangers that it poses. Technical limitation to conventional urban drainage method is an imperative factor that decision makers and planners face. To overcome these limitations as well as preventing ecological problems in the future, there is need to measure today's system. This can be achieved through sanitary approach which involves more community participation in actualizing the goals of proper and effective sanitation process. There is also the need to accentuate efforts on the construction of concrete drainage system, which should be make very functional by ensuring that waste are not dumped into them, and environmental education with an emphasis on the techniques for interacting with drainage system.

5. RECOMMENDATIONS

In order to ensure a sustainable and drainage system, the following recommendations are made:

1. There should be policy development based on a renewed understanding of the environmental situation in Maiduguri.
2. Necessary measures should be put in place to rehabilitate all the bad drainage systems.
3. Existing waste legislation should be enforced to promote education and awareness amongst the people toward waste disposal issues and its adverse impacts on health.
4. The topography of the area should be properly studies before construction of drainage.
5. The width, length and depth of drainage should be standard and expanded.
6. Proper drainage designs and technical knowhow should improve upon.

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