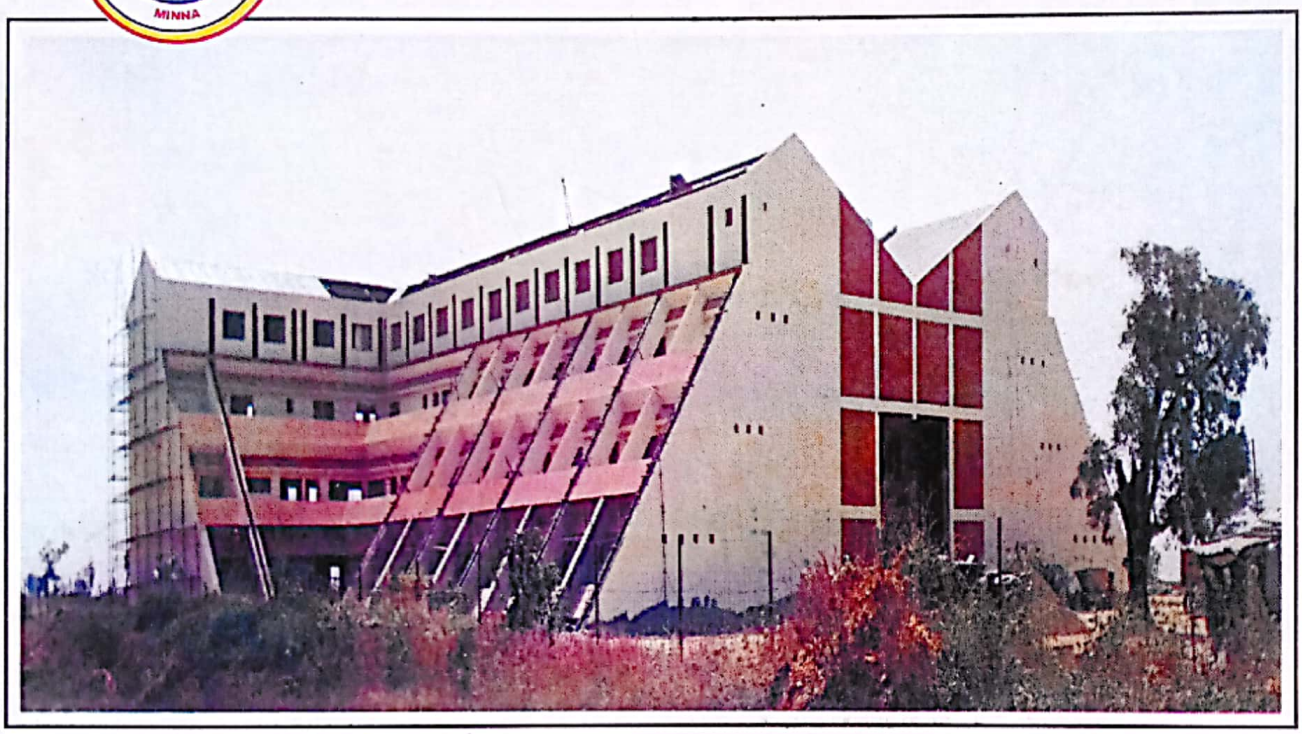
2ND ANNUAL CONFERENCE

SCHOOL OF ENVIRONMENTAL TECHNOLOGY (S.E.T.)

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA



BOOK OF PROCEEDINGS

Theme:

PRESERVING THE ENVIRONMENT

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Edited by:

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ACKNOWLEDGEMENT

This Conference was the second to be organized by the School of Environmental Technology of this University.

Members of the Local Organizing Committee hereby acknowledge, with profound sense of gratitude, the contributions of the Vice-Chancellor and Management of the FUT Minna, without which the successful conduct of the 2nd SET Conference would have been impossible.

In particular, we are grateful to the Dean of SET, Prof. T.C. Mogbo, for his moral, financial and material support towards the conference and the opportunity bestowed on us to organize it. We also appreciate all the staff of the School and the University community in general for their goodwill, cooperation and support in the course of holding the Conference.

Deep appreciation and special thanks are due to all contributors for their strengths of purpose, commitments and the intellectual values of their contributions to the conference.

Most of all, we are grateful to the Almighty for steering the path to a very successful end.

ADDRESS BY THE EXECUTIVE GOVERNOR, NIGER STATE, AT THE 2ND NATIONAL CONFERENCE OF THE SCHOOL OF ENVIRONMENTAL TECHNOLOGY, F.U.T. MINNA ON 28TH FEBRUARY, 2008

I was very pleased when I received the invitation to be present at this conference because the theme *"Preserving the Environment"* is an issue that is of top priority to the government of Niger State. We all know how important the environment is to us. We live in it and carry out our daily businesses within it. Therefore it is necessary for us to preserve it for our own good and the good of the future generation. The issue of preserving the environment is global because the effect of human activity misuse and abuse of the environment is global. Environmental pollution in its different forms – air, water, land and noise, has to be tackled without delay.

Here in Minna and environs, we are already trying to correct the errors of the past as far as the environment is concerned. Illegal structures are being removed to make way for a better and healthier environment. The markets in Minna are also being re-planned to create cleaner markets with better circulation and less chances of fire outbreak. The issue of slums is being addressed so that in the very near future, Niger State will be a model for other states to emulate.

As regards renewable sources of energy, the government is already taking steps in that direction. The contract has recently been awarded for the installation of solar powered street lights in Minna. This will make sure that our streets are well lit and therefore enhance the safety and security of the citizens of the state. The noise and air pollution generated by the numerous generators that have become the order of the day in Nigeria today is of much

concern to the government. These generators also pose a fire hazard to the populace. The government will be very interested in research findings that propose other forms of renewable energy that will be less harmful to the environment. In fact, officials of the government and representatives of the University have already met to identify areas in which they can work together to ensure the progress of this state in various aspects of scientific and technological development.

It is hoped that this conference will help to educate the citizens of the need to engage in healthy environmental practices. The government of Niger State will be very open to the new ideas and findings that will emanate from this conference.

I wish you very fruitful deliberations.

Thank you,

Dr Muazu Babangida Aliyu (OON)
(Talban Minna)
Executive Governor of Niger State

EFFECTS OF UNREGULATED URBAN DEVELOPMENT ON FLOODING IN THE NIGERIAN ENVIRONMENT

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ABSTRACT

Floods make an enormous impact on the environment and society. Floods destroy drainage systems in cities, causing raw sewage to spill out into bodies of water. Also, in cases of severe floods, buildings can be significantly damaged and even destroyed. This can lead to catastrophic effects on the environment as many toxic materials such as paint, pesticide and garbage can be released into the rivers, lakes, bays, and ocean, killing marine life. Floods may also cost billions of Naira worth of damage to a city, both evicting people from their homes and ruining businesses. It causes significant amounts of erosion to coasts, leading to more frequent flooding if not repaired; a case in point is Lagos bar beach. However floods do make a slight positive impact on the environment as it spreads sediment containing beneficial nutrients to topsoil that might never arrive there otherwise. This paper will attempt to examine the effects of urban development on flooding in Nigeria.

Key words: Development, Environment, Erosion Floods, Homes.

1.0 INTRODUCTION

> *A flood is when there is too much rain to be absorbed by the earth and the water stays on top of the earth and runs off to the rivers and seas. The water fills up the rivers and then the rivers overflow their banks and the water comes onto the land and a flood devastates the land (Molly 2006).*

Over the past century, Nigeria has become an increasingly urban society. The changes in land use associated with urban development affect flooding in many ways. Removing vegetation and soil, grading the land surface, and constructing drainage networks increase runoff to streams from rainfalls. As a result, the peak discharge, volume, and frequency of floods increase in nearby streams. Changes to stream channels during urban development can limit their capacity to convey floodwaters. Roads and buildings constructed in flood-prone areas are exposed to increased flood hazards, including inundation and erosion, as new development continues.

Objectives:

The objectives of this paper are

- identify urban development as a agent of flooding
- identify the various effects by which urban development contribute to flooding
- Proffer measures through which we can reduce flooding in developed urban areas

2.0 THEORETICAL BACKGROUND

2.1 HYDROLOGIC EFFECTS OF URBAN DEVELOPMENT

Streams are fed by runoff from rainfall and snowmelt moving as overland or subsurface flow. Floods occur when large volumes of runoff flow quickly into streams and rivers. The peak discharge of a flood is influenced by many factors, including the intensity and duration of storms and snowmelt, the topography and geology of stream basins, vegetation, and the hydrologic conditions preceding storm and snowmelt events.

Land use and other human activities also influence the peak discharge of floods by modifying how rainfall and snowmelt are stored on and run off the land surface into streams. In undeveloped areas such as forests and grasslands, rainfall and snowmelt collect and are stored on vegetation, in the soil column, or in surface depressions. When this storage capacity is filled, runoff flows slowly through soil as subsurface flow. In contrast, urban areas, where much of the land surface is covered by roads and buildings, have less capacity to store rainfall and snowmelt. Construction of roads and buildings often involves removing vegetation, soil, and depressions from the land surface. The permeable soil is replaced by impermeable surfaces such as roads, roofs, parking lots, and sidewalks that store little water, reduce infiltration of water into the ground, and accelerate runoff to ditches and streams. Even in suburban areas, where lawns and other permeable landscaping may be common, rainfall and snowmelt can saturate thin soils and produce overland flow, which runs off quickly. Dense networks of ditches and culverts in cities reduce the distance that runoff must travel overland or through subsurface flow paths to reach streams and rivers. Once water enters a drainage network, it flows faster than either overland or subsurface flow.

With less storage capacity for water in urban basins and more rapid runoff, urban streams rise more quickly during storms and have higher peak discharge rates than do rural streams. In addition, the total volume of water discharged during a flood tends to be larger for urban streams than for rural streams.. As with any comparison between streams, the differences in stream flow cannot be attributed solely to land use, but may also reflect differences in geology, topography, basin size and shape, and storm patterns.

The hydrologic effects of urban development often are greatest in small stream basins where, prior to development, much of the precipitation falling on the basin would have become subsurface flow, recharging aquifers or discharging to the stream network further downstream. Moreover, urban development can completely transform the landscape in a small stream basin, unlike in larger river basins where areas with natural vegetation and soil are likely to be retained.

2.2 HYDRAULIC EFFECTS FROM CHANGES TO STREAM

CHANNELS AND FLOODPLAINS

Development along stream channels and floodplains can alter the capacity of a channel to convey water and can increase the height of the water surface (also known as stage) corresponding to a given discharge. In particular, structures that encroach on the floodplain, such as bridges, can increase upstream flooding by narrowing the width of the channel and increasing the channel's resistance to flow. As a result, the water is at a higher stage as it flows past the obstruction, creating a backwater that will inundate a larger area upstream (Anderson D.G 1968).

Sediment and debris carried by floodwaters can further constrict a channel and increase flooding. This hazard is greatest upstream of culverts, bridges, or other places where debris collects. Small stream channels can be filled with sediment or become clogged with debris, because of undersized culverts, for example. This creates a closed basin with no outlet for runoff. Although channels can be engineered to convey floodwater and debris quickly downstream, the local benefits of this approach must be balanced against the possibility of increased flooding downstream.

Erosion in urban streams represents another consequence of urban development. Frequent flooding in urban streams increases channel and bank erosion. Where channels have been straightened and vegetation has been removed from channel banks, streamflow velocities will increase, allowing a stream to transport more sediment. In many urban areas, stream-bank erosion represents an ongoing threat to roads, bridges, and other structures that is difficult to control even by hardening stream banks.

2.3 EFFECTS OF URBAN DEVELOPMENT ON FLOOD DISCHARGE

AND FREQUENCY

Common consequences of urban development are increased peak discharge and frequency of floods. Typically, the annual maximum discharge in a stream will increase as urban development occurs, although the increase is sometimes masked by substantial year-to-year variation in storms. The effects of development in urban basins are most pronounced for moderate storms following dry periods. For larger storms during wet periods, the soil in rural basins becomes saturated and additional rainfall or snowmelt runs off much as it does in an urban basin. The frequency of moderate flooding can increase substantially after development(Christopher P.K 2004).

3.0 REDUCING FLOOD HAZARDS IN URBAN AREAS

There are many approaches for reducing flood hazards in basins under development. Areas identified as flood-prone should be used for parks and playgrounds that can tolerate occasional flooding. Buildings and bridges should be elevated, protected with floodwalls and levees, or designed to withstand temporary inundation. Drainage systems should be expanded to increase their capacity for detaining and conveying high streamflows. Techniques that promote infiltration and storage of water in the soil column, such as infiltration trenches, permeable pavements, soil amendments, and reducing impermeable surfaces should also be incorporated into new and existing residential and commercial developments to reduce runoff from these areas.

4.0 CONCLUSIONS

Urbanization generally increases the size and frequency of floods and may expose communities to increasing flood hazards. Current streamflow information should be available as this provides a scientific foundation for flood planning and management in urban areas. Because flood hazard maps based on streamflow data from a few decades ago may no longer be accurate today, floodplain managers need new peak streamflow data to update flood frequency analyses and flood maps in areas with recent urbanization. Streamflow-gaging stations provide a continuous record of streamflow that can be used in the design of new urban infrastructure including roads, bridges, culverts, channels, and detention structures. Stormwater managers can use streamflow information in combination with rainfall records to evaluate innovative solutions for reducing runoff from urban areas. Real-time streamflow-gaging stations, which make streamflow and rainfall data available via the internet and other communications networks as they are recorded, offer multiple benefits in urban watersheds. In particular, they provide flood managers with information that can guide flood control operations and emergency actions such as evacuations and road closures.

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