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# The Effects Of Flood In Relation To Geotechnical Properties Of The Soil And Human Activities (Case Study Of Lokoja River Bank, North Central Nigeria)

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---------------------------------------------------------***ABSTRACT***---------------------------------------------------------

***:****The study area, Lokoja river bank has been under the effect of flood for some time now, to study the effect of the floods on man and the environment, soil samples were collected along the river bank for analysis. 10 soil samples were collected from 10 locations for analysis at the Civil Engineering Department of Kogi State Polytechnic, Itakpe Campus. The Engineering properties of soil analyzed for are moisture content, particle size Distribution, compaction, specific gravity, consistency limit of the soil such as plasticity, liquid and plastic index. The result shows that the soil grain sizes ranges from medium-coarse grain (0.2 to 2mm) on sieve no 200. Samples at location 6 and 9 which is mainly medium grain sand have liquid limit (LL) of 19.3% and 23.0% which are good for construction, while sands obtained at other location have LL that ranges from 24. 0% to 44.0% which are not suitable for construction.*

*The coarse grain sand at location 2,3,4 have an average plasticity limit (PL) of 36.4% are equally not good for construction because of clay component excepted when treated.*

*The soils were well graded because of its river transport.*

*The flood has submerged houses, lives and properties are equally lost to the flood farm land are equally submerged by the flood. Governments have started remediating measure such as erection of flood breaker and sand filling.*

***KEY WORD:*** *Flood, Environment, Engineering Properties, Soil*

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## I. INTRODUCTION

Floods are major disasters affecting many countries of the world annually, especially in most flood plain areas. Floods do not only damage properties and endanger the lives of humans and animals but also produce other secondary effects like outbreak of disease such as cholera and malaria as well. Flooding is commonly caused by heavy down pours of rains on flat ground, reservoir failure, volcano, melting of snow and or glaciers etc.

Flooding is caused by several factors and is invariably preceded by heavy rainfall. The other causes of flooding are moderate to severe wind over water, unusual high tides, tsunami due to undersea earthquakes, break or failures of dams, levees, retention ponds or lakes, or other infrastructures that that retain surface water. Flooding can be aggravated by impervious surfaces or other natural and man-made hazards which destroy soil, vegetation that can absorb rainfall.

Although flooding is a natural occurrence, man made changes to the land can also be a factor. Development those not change flooding but can only make it worst. In city and suburbs, pavement and rooftops prevent some rainfall from being absorbed by the soil. This can increase the amount of runoff flowing into low lying areas or the storm drain system.

The town of Lokoja as a settlement has on a river bank is not an exception. it has witnessed several devastating floods, occurring almost on an annual basis, in its recent history, especially from 1991, due to rapid and uncontrolled urbanization of the town (Mabel, 2014).the release of water from Ladgo dam in Cameroon into the river Benue flood plain, and similar release from kainji, jebba and shiroro dam on the river Niger were largely responsible for the 2012 flooding in Nigeria of which Lokoja, a confluence town of river Niger and Benue were adversely affected. The annual rainfall in the area is between 1016mm and 1524mm with its mean

and temperature not falling below 27°C. The rainy season lasts from April to October while the dry season last from November to march. The land rises from about 300meters along the River Niger-Benue confluence, to the heights of between 300meters and 600meters above the sea level in the uplands.
The significance of the year 2012 flood disaster in Nigeria lies in the fact that they are unprecedented in the past forty years. Most part of the central state of Nigeria and other adjoining states along the river Niger and Benue were devastated by these floods, causing huge destruction to the rural and urban infrastructures (farmlands/crops, roads, buildings, drainages ,bridges, power lines etc) and socio-economic lives of the areas.

Flood occurs when the soil, stream channels and man-made reservoirs cannot absorb or contain all the water. A flood that occurs suddenly, with little or no prior signs is called a flashflood and it is due to intense rainfall over a relatively small area, it is inevitable, resulting from the natural rainfall run off process. It is a natural phenomenon and its magnitude is periodic. The periodicity of flood implies that every year of some area surrounding the river (on both sides) is flooded.

**Location**

Lokoja, the study area is located between latitude 7°51' 04. 34°N and longitude 6°41′55.64'E and 6°45'36.58'E with a total land area of 29,833km². it share political boundaries with Niger, kwara and Nassarawa states respectively and the Federal Capital Territory to the North, Benue state to the East , Adavi and Okehi local government areas to the south and kabba Bunu ( LGA ) by west.

The general relief is undulating and its characterized by high hills. The Niger-Benue trough is a Y-shaped lowland area which which divide the sub-humid zone into three parts. The land rises from rises from about 300meters along the Niger-Benue confluence reaching up to 600 meters above the sea level in the uplands. Lokoja is drained by river Niger and River Benue and their tributaries. It has been deeply dissected by erosion into the tabular hills separated by river valleys. The flood plains of the River Niger and Benue River valleys at Lokoja, is made up of hydromorphic soils which is a mixture of coarse alluvial and colloidal deposits. The alluvial soil along the valley of the river are sandy, while the adjoining laterite soil are deeply deeply weathered and grey or reddish in colour. The soil are generally characterized by a sandy surface horizon overlying a weakly structured clay accumulation.

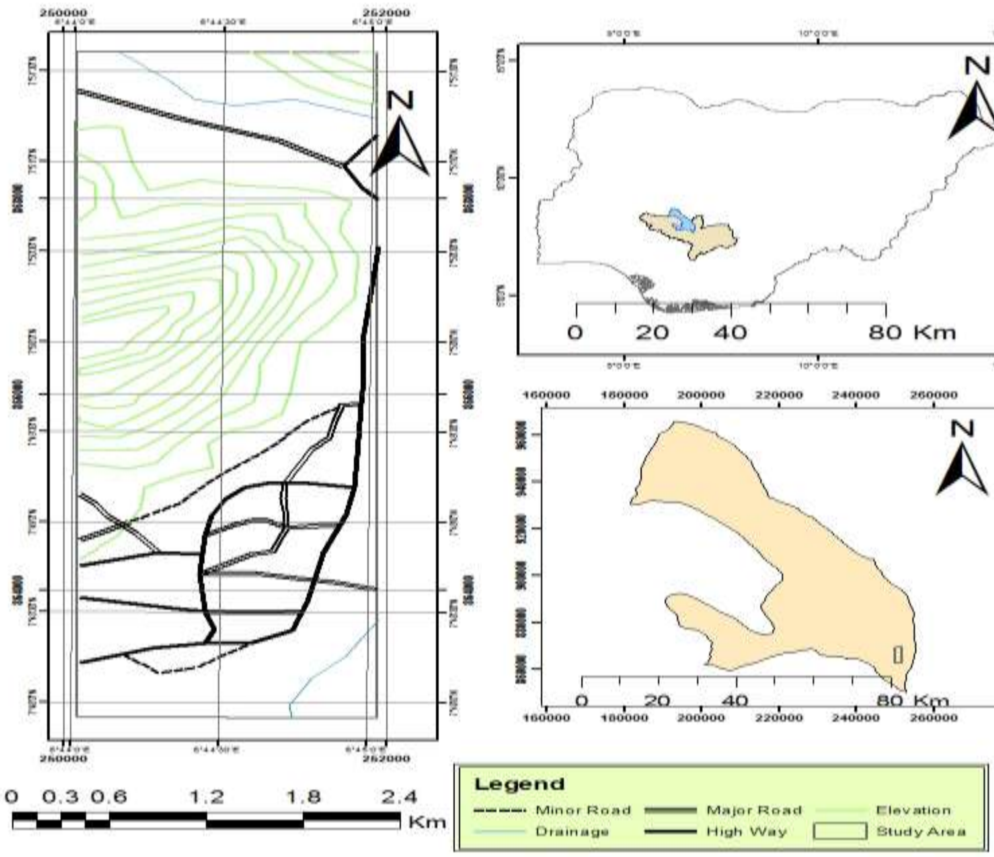


**Fig. 1: Location Map of the Study Area**

**Geology and Hydrogeology of the area**

The study area is dominantly underlain by the Precambrian Basement Complex; however, part of the area is underlain by Cretaceous sediment which unconformably overlies the Basement Complex.

Migmatite covers about half of the study area outcropping at the southwest, west, northwest and central parts of the area. The South and the southeast parts of the area are underlain by undifferentiated older granite, mainly porphyroblastic granite, granite gneiss with porphyroblastic gneiss and fine grained biotite granite. The northern part of the area is made of ridges (Mount Patti) of Cretaceous sediments of the Southern Bida Basin (Lokoja Sub- Basin). The ridges are dominantly composed of feldspathic sandstone and siltstone which are separated by the biotite hornblende gneiss. Thick alluvial deposit occurs around the Rivers Niger and Benue drainage system

Lokoja, located in the plains of River Niger at the confluence with River Benue, falls within both the crystalline and sedimentary hydrogeological provinces.

The study area contains the confluence point where River Niger and River Benue meet. The Niger River basin is 2.3million km$^2$ bound by latitudes 5°N and 23°N and longitudes 12°W and 17°E. The river rises in Guinea and flows for about 4,200 km through Mali, Niger and Nigeria before reaching the Atlantic Ocean. Its main tributary,

The Benue River flows west from the Cameroon and joins the Niger at Lokoja. Precipitation in the basin is variable. It ranges from 2,700 mm/yr close to the river mouth to almost none in the desert parts. Overall water balance shows that out of the 48,000 m$^3$/s of water that enters the Niger River basin through precipitation, 42,900m$^3$/s (89%) is lost in overland flow and 1,100 m$^3$/s (2%) in stream flow, leaving only 4,000 m$^3$/s (9%) at the river mouth (Olivera et al., 1995).

The groundwater availability in crystalline rocks in the area is greatly dependent on the degree of weathering and fracturing of the rocks and the interconnectivity of the fractures. The area is generally drained by Rivers Niger, Benue and River Mimi, a tributary of River Niger. Aquifers found in this area are recharged directly by precipitation but can also be recharged by infiltration from Rivers Niger, Benue and Mimi. Groundwater abstraction is mainly by hand-dug wells, boreholes and from springs.

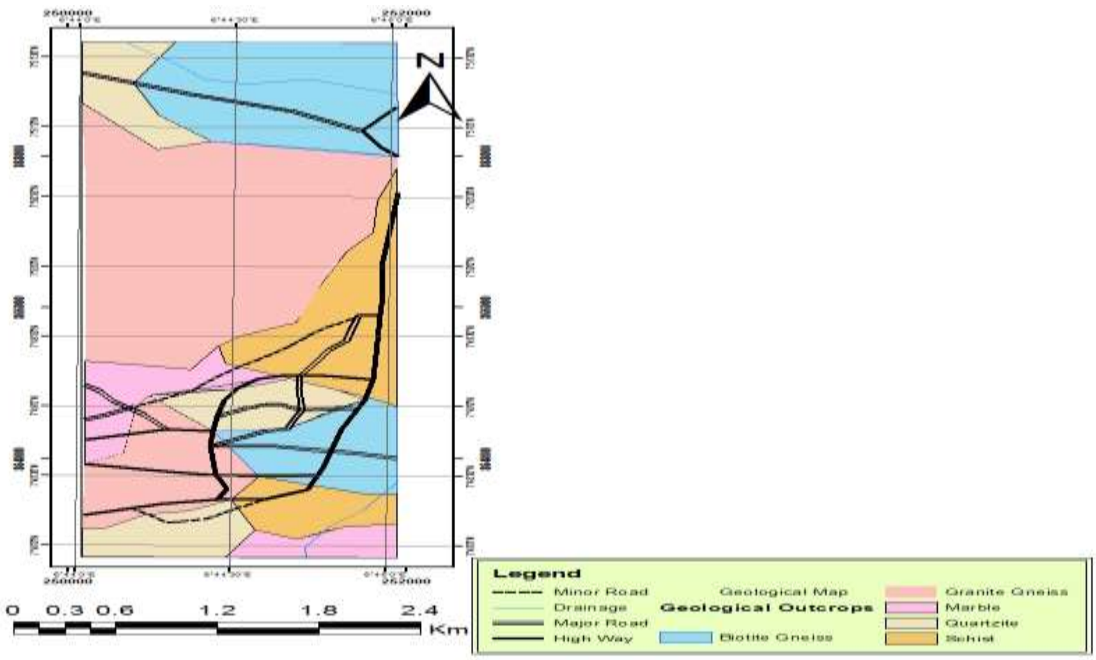


**Fig. 2: Geological Map of the Study Area**

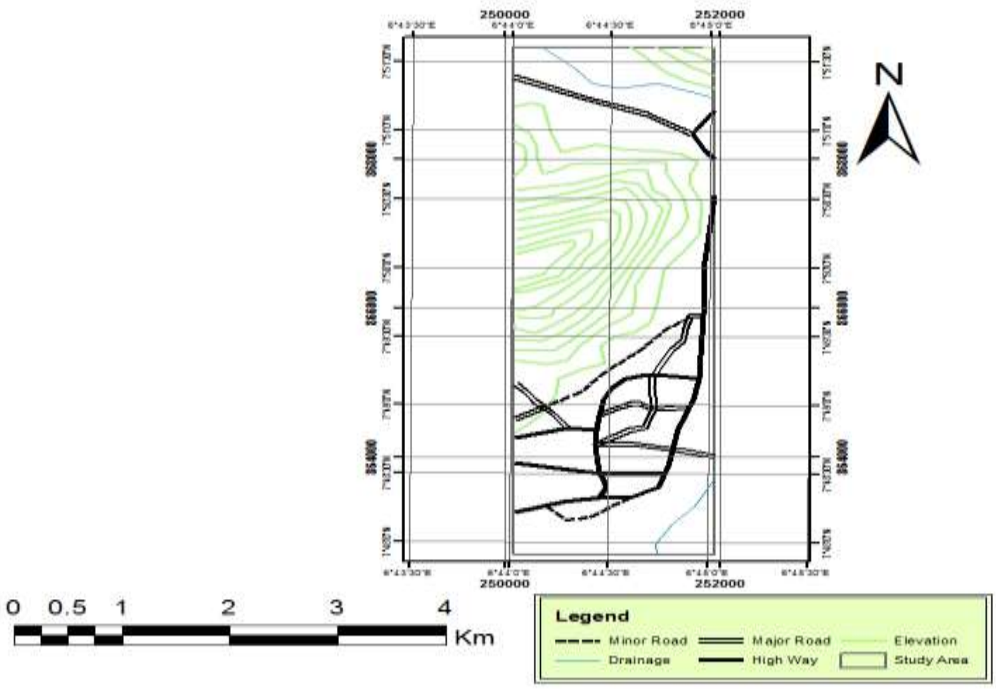


**Fig 3:Topographical Map of the Study Area**

## II. MATERIALS AND METHOD

The materials used in the study are: Global positioning system (GPS), Sampling bag, Markers, Spatula, Masking tape, measuring tape, Proctor rammer, Scoopers, Desiccators, Sieve.

## III. RESULTS AND DISCUSSION

The tables below show the results of the various tests done on the soil sample

**Particle Size Distributions**

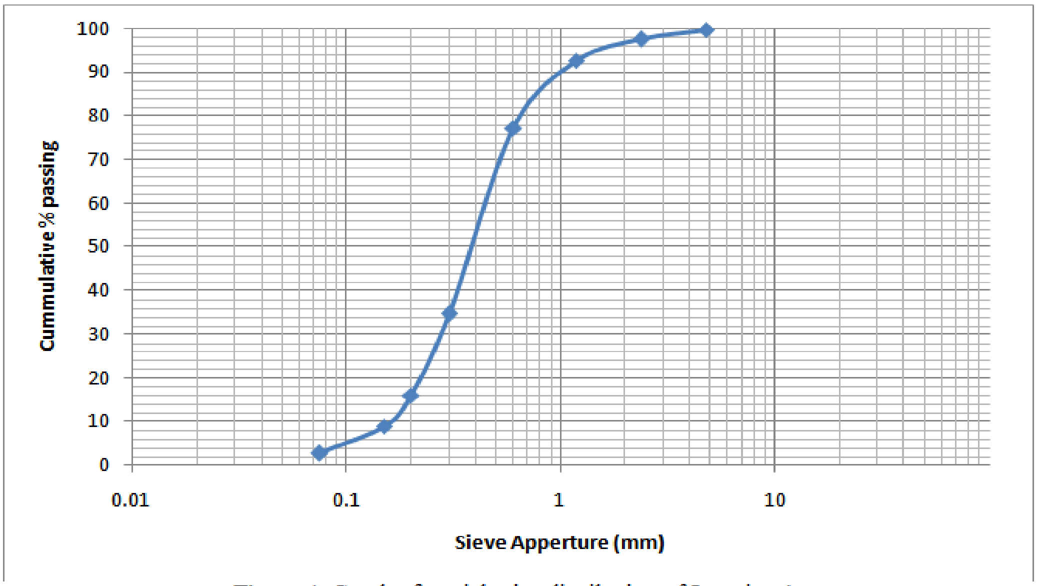


**Figure 4:** Graph of particle size distribution of Location 1

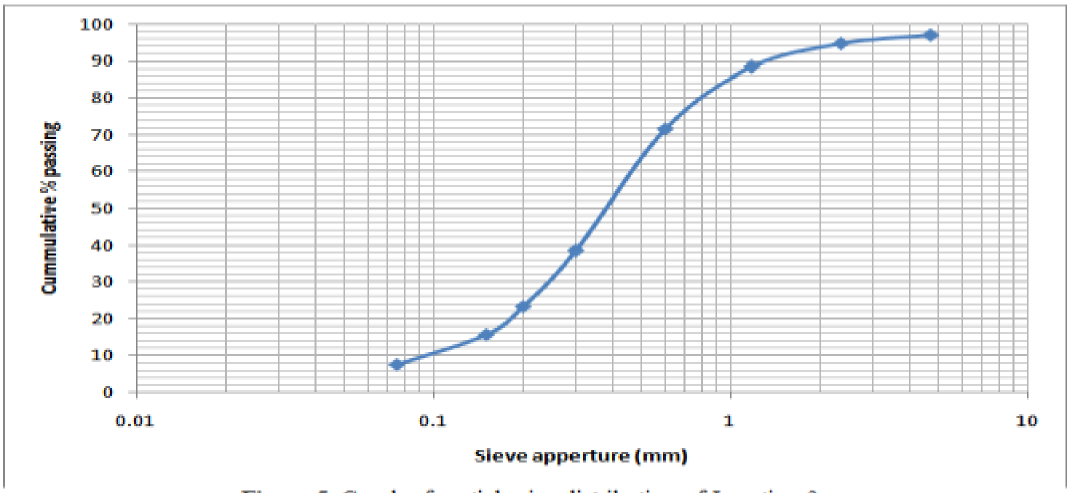


**Figure 5**: Graph of particle size distribution of Location 2

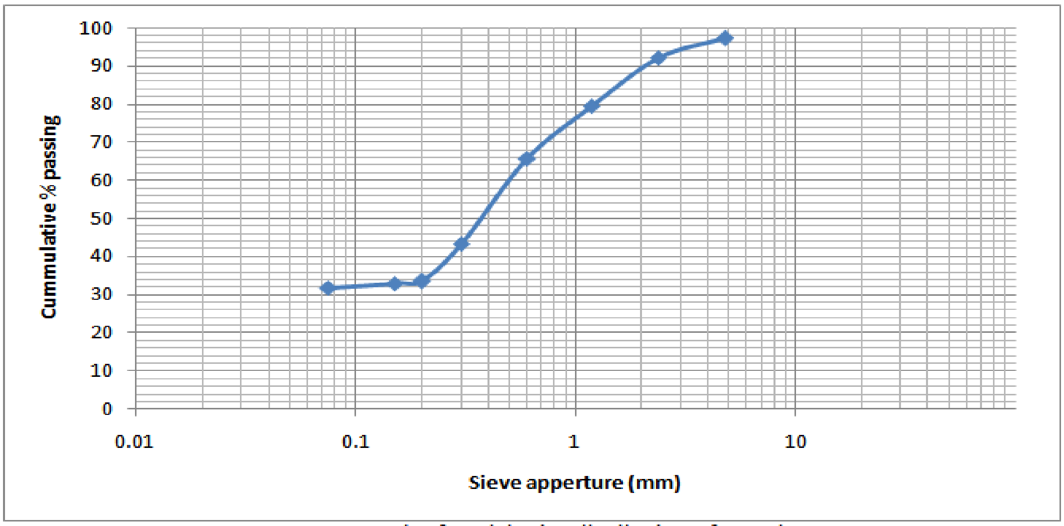


**FIGURE 6:** Graph of particle size distribution of Location 3

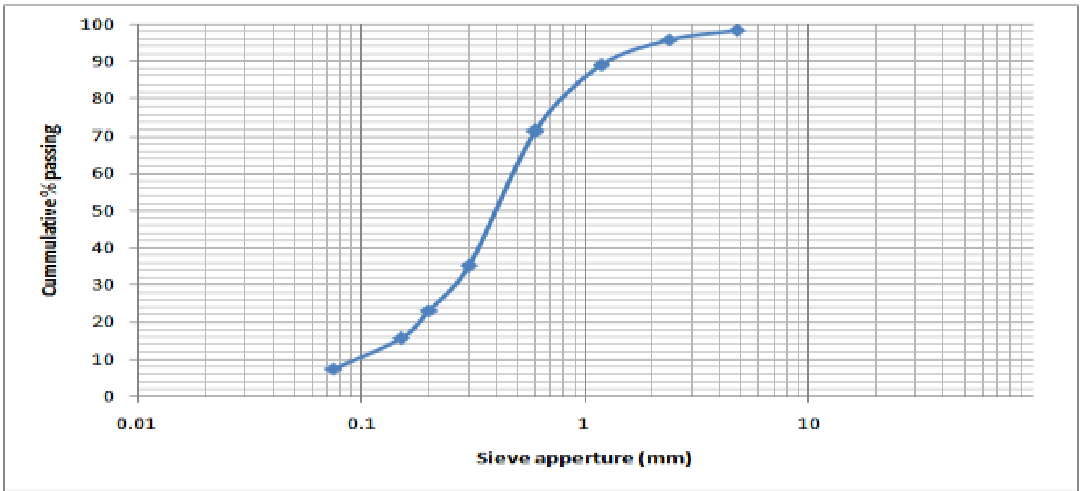


**FIGURE 7**: Graph of particle size distribution of Location 7

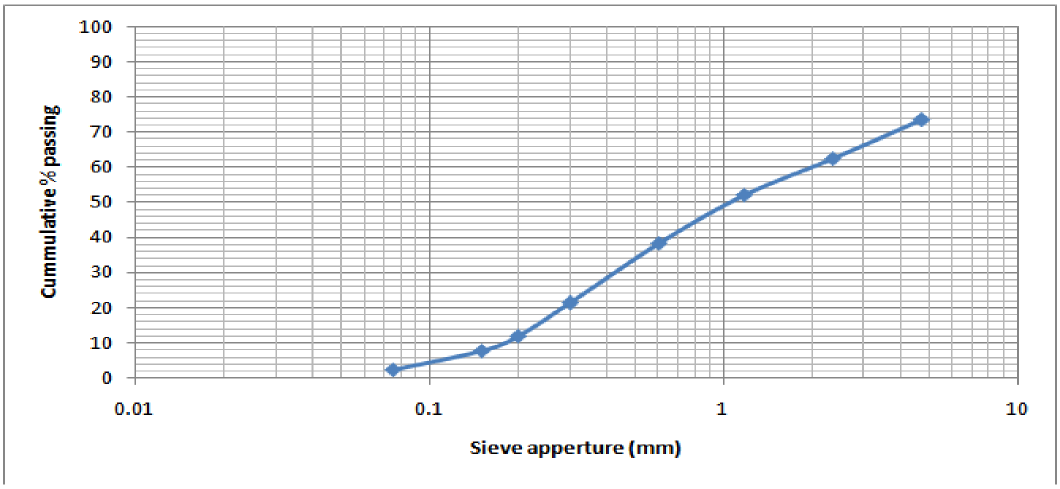


**FIGURE 8:** Graph of particle size distribution of Location 8

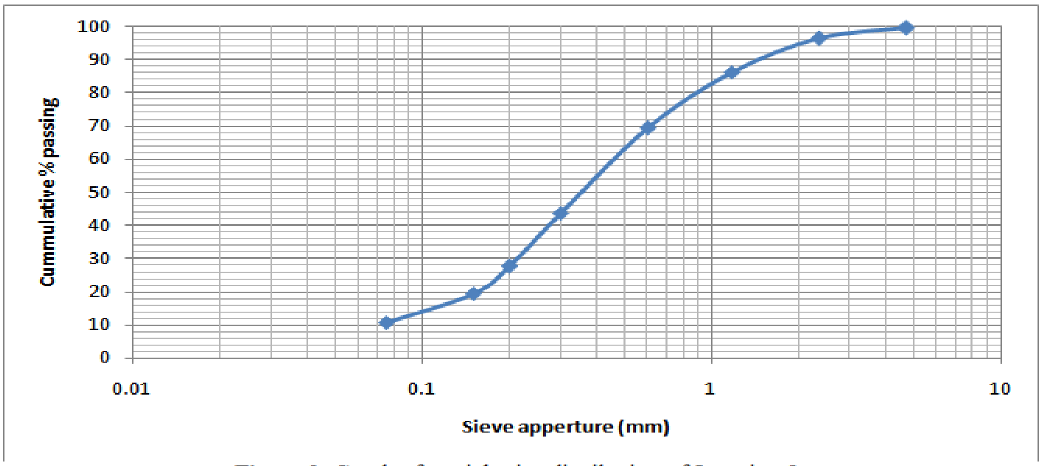


**Figure 9:** Graph of particle size distribution of Location 9

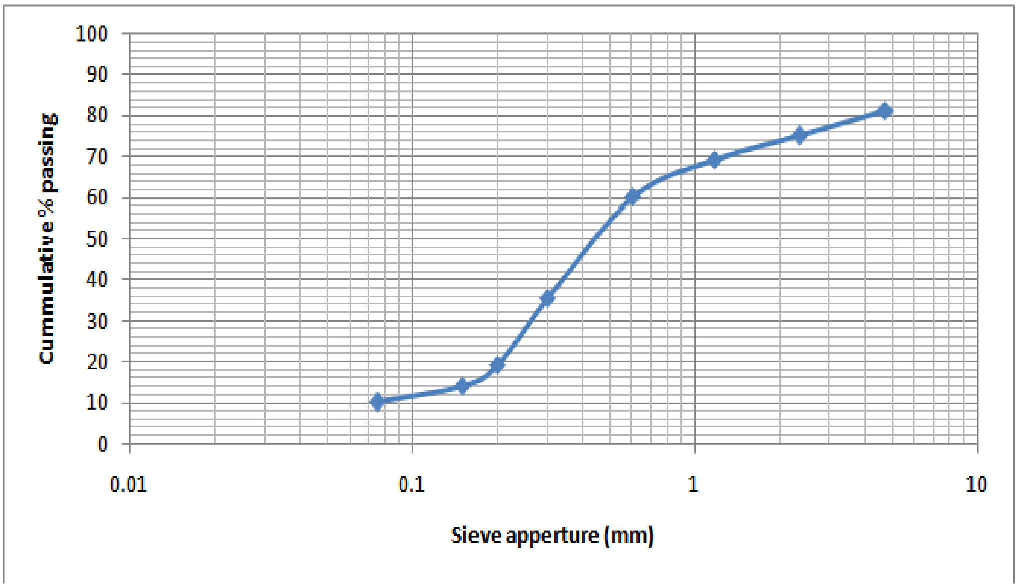


**FIGURE 10:** Graph of particle size distribution of Location 7

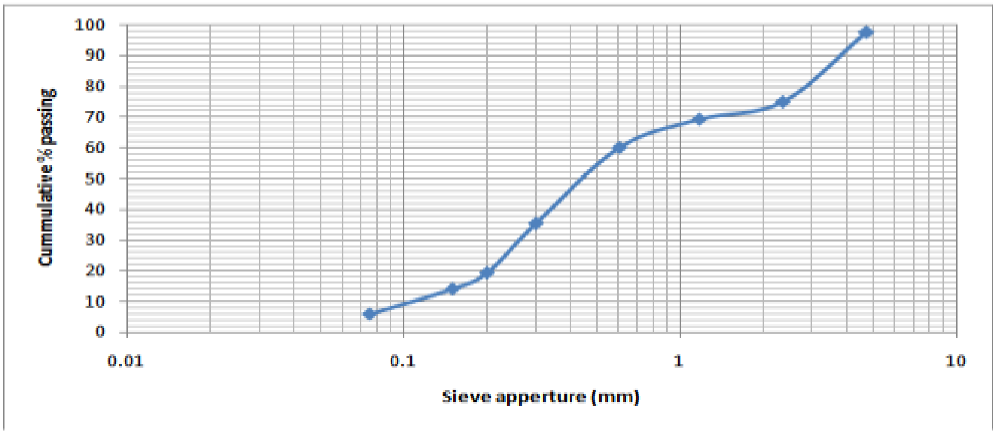


**FIGURE11**: Graph of particle size distribution of Location 8

**ATTERBERG LIMITS**

The Atterberg limits conducted were liquid limit (LL) and plastic limit (PL).
Table 4.2 shows the results of the Atterberg limit tests conducted on the soil

**L 1**

**TABLE 12 :ATTERBERG LIMIT (LIQUID AND PLASTIC LIMITS )**

| Type of Test | Liquid Limit (LL) | | | Plastic Limit (PL) | | |
|---|---|---|---|---|---|---|
| Container No | 1 | 2 | 3 | 1 | 2 | 3 |
| No. of Blows | 44 | 28 | 15 | | | |
| Moisture can and lid number | | | | | | |
| Mass of Empty can, m1 (g) | 14.4 | 15.5 | 14.9 | 15.4 | 14.8 | 13.7 |
| Mass of can + Moist Soil, m2 (g) | 16.5 | 18 | 18 | 16.3 | 15.8 | 14.6 |
| Mass of can + Dry Soil, m3 (g) | 15.9 | 17.3 | 17.1 | 16.1 | 15.6 | 14.4 |
| Mass of Soil (g) | 1.5 | 1.8 | 2.2 | 0.7 | 0.8 | 0.7 |
| Mass of Water (g) | 0.6 | 0.7 | 0.9 | 0.2 | 0.2 | 0.2 |
| Moisture Content (%) | 40.0 | 38.9 | 40.9 | 28.6 | 25.0 | 28.6 |
| **PI = 12.5** | **39.9** | | | **27.4** | | |

**L 2**

**Table 13: ATTERBERG LIMIT (LIQUID AND PLASTIC LIMITS )**

| Type of Test | Liquid Limit (LL) | | | Plastic Limit (PL) | | |
|---|---|---|---|---|---|---|
| Container No | 1 | 2 | 3 | 1 | 2 | 3 |
| No. of Blows | 42 | 36 | 20 | | | |
| Moisture can and lid number | | | | | | |
| Mass of Empty can, m1 (g) | 14.8 | 13.7 | 15.5 | 15.5 | 14.2 | 14.9 |
| Mass of can + Moist Soil, m2 (g) | 19.9 | 21.7 | 24.7 | 16.3 | 15.4 | 16.3 |
| Mass of can + Dry Soil, m3 (g) | 18.3 | 19.3 | 21.8 | 16.1 | 15.2 | 15.8 |
| Mass of Soil (g) | 3.5 | 5.6 | 6.3 | 0.6 | 1 | 0.9 |
| Mass of Water (g) | 1.6 | 2.4 | 2.9 | 0.2 | 0.2 | 0.5 |
| Moisture Content (%) | 45.7 | 42.9 | 46.0 | 33.3 | 20.0 | 55.6 |
| **PI = 8.6** | **44.9** | | | **36.3** | | |

**L 3**

**Table 14: ATTERBERG LIMIT (LIQUID AND PLASTIC LIMITS )**

| Type of Test | Liquid Limit (LL) | | | Plastic Limit (PL) | | |
|---|---|---|---|---|---|---|
| Container No | 1 | 2 | 3 | 1 | 2 | 3 |
| No. of Blows | 42 | 36 | 20 | | | |
| Moisture can and lid number | | | | | | |
| Mass of Empty can, m1 (g) | 14.8 | 13.7 | 15.5 | 15.5 | 14.2 | 14.9 |
| Mass of can + Moist Soil, m2 (g) | 19.7 | 21.6 | 23.9 | 16.3 | 15.4 | 16.3 |
| Mass of can + Dry Soil, m3 (g) | 18.3 | 19.3 | 21.5 | 16.1 | 15.2 | 15.8 |
| Mass of Soil (g) | 3.5 | 5.6 | 6 | 0.6 | 1 | 0.9 |
| Mass of Water (g) | 1.4 | 2.3 | 2.4 | 0.2 | 0.2 | 0.5 |
| Moisture Content (%) | 40.0 | 41.1 | 40.0 | 33.3 | 20.0 | 55.6 |
| **PI = 4.1** | **40.4** | | | **36.3** | | |

**L 4**

**Table 15: ATTERBERG LIMIT (LIQUID AND PLASTIC LIMITS )**

| Type of Test | Liquid Limit (LL) | | | Plastic Limit (PL) | | |
|---|---|---|---|---|---|---|
| Container No | 1 | 2 | 3 | 1 | 2 | 3 |
| No. of Blows | 42 | 36 | 20 | | | |
| Moisture can and lid number | | | | | | |
| Mass of Empty can, m1 (g) | 14.8 | 13.7 | 15.5 | 15.5 | 14.2 | 14.9 |
| Mass of can + Moist Soil, m2 (g) | 19.9 | 21.7 | 24.7 | 16.3 | 15.4 | 16.3 |
| Mass of can + Dry Soil, m3 (g) | 18.4 | 19.3 | 22 | 16.1 | 15.1 | 15.9 |
| Mass of Soil (g) | 3.6 | 5.6 | 6.5 | 0.6 | 0.9 | 1 |
| Mass of Water (g) | 1.5 | 2.4 | 2.7 | 0.2 | 0.3 | 0.4 |
| Moisture Content (%) | 41.7 | 42.9 | 41.5 | 33.3 | 33.3 | 40.0 |
| **PI = 6.4** | **42.0** | | | **35.6** | | |

**L 5**

**Table 16: ATTERBERG LIMIT (LIQUID AND PLASTIC LIMITS )**

| Type of Test | Liquid Limit (LL) | | | Plastic Limit (PL) | | |
|---|---|---|---|---|---|---|
| Container No | A | B | C | D | E | F |
| No. of Blows | 17 | 52 | 58 | | | |
| Moisture can and lid number | | | | | | |
| Mass of Empty can, m1 (g) | 14.3 | 14.6 | 14.8 | 15.5 | 14.2 | 14.9 |
| Mass of can + Moist Soil, m2 (g) | 15.8 | 16.9 | 17.7 | 16.5 | 16 | 15.9 |
| Mass of can + Dry Soil, m3 (g) | 15.5 | 16.5 | 17.1 | 16.4 | 15.8 | 15.8 |
| Mass of Soil (g) | 1.2 | 1.9 | 2.3 | 0.9 | 1.6 | 0.9 |
| Mass of Water (g) | 0.3 | 0.4 | 0.6 | 0.1 | 0.2 | 0.1 |
| Moisture Content (%) | 25.0 | 21.1 | 26.1 | 11.1 | 12.5 | 11.1 |
| **PI = 12.4** | **24.0** | | | **11.6** | | |

**L 6**

**Table 17: ATTERBERG LIMIT (LIQUID AND PLASTIC LIMITS )**

| Type of Test | Liquid Limit (LL) | | | Plastic Limit (PL) | | |
|---|---|---|---|---|---|---|
| Container No | A | B | C | D | E | F |
| No. of Blows | 29 | 34 | 26 | | | |
| Moisture can and lid number | | | | | | |
| Mass of Empty can, m1 (g) | 14.3 | 14.6 | 14.8 | 15.5 | 14.2 | 14.9 |
| Mass of can + Moist Soil, m2 (g) | 15.6 | 16.3 | 16.1 | 16.2 | 15.4 | 15.8 |
| Mass of can + Dry Soil, m3 (g) | 15.4 | 16 | 15.9 | 16.2 | 15.3 | 15.7 |
| Mass of Soil (g) | 1.1 | 1.4 | 1.1 | 0.6 | 1.1 | 0.8 |
| Mass of Water (g) | 0.2 | 0.3 | 0.2 | 0.05 | 0.1 | 0.1 |
| Moisture Content (%) | 18.2 | 21.4 | 18.2 | 7.7 | 9.1 | 12.5 |
| **PI = 9.5** | **19.3** | | | **9.8** | | |

**L 7**

Table 18: ATTERBERG LIMIT (LIQUID AND PLASTIC LIMITS )

| Type of Test | Liquid Limit (LL) | | | Plastic Limit (PL) | | |
|---|---|---|---|---|---|---|
| Container No | A | B | C | D | E | F |
| No. of Blows | 49 | 41 | 23 | | | |
| Moisture can and lid number | | | | | | |
| Mass of Empty can, m1 (g) | 14.3 | 14.6 | 14.8 | 15.5 | 14.2 | 14.9 |
| Mass of can + Moist Soil, m2 (g) | 15.3 | 16.5 | 16.8 | 16.9 | 16.5 | 16.2 |
| Mass of can + Dry Soil, m3 (g) | 15.0 | 16.0 | 16.3 | 16.7 | 16.2 | 16.0 |
| Mass of Soil (g) | 0.7 | 1.4 | 1.5 | 1.2 | 2.0 | 1.1 |
| Mass of Water (g) | 0.3 | 0.5 | 0.5 | 0.2 | 0.3 | 0.2 |
| Moisture Content (%) | 42.9 | 35.7 | 33.3 | 16.7 | 15.0 | 18.2 |
| **PI = 12.0** | **28.6** | | | **16.6** | | |

**L 8**

**Table 19: ATTERBERG LIMIT (LIQUID AND PLASTIC LIMITS )**

| Type of Test | Liquid Limit (LL) | | | Plastic Limit (PL) | | |
|---|---|---|---|---|---|---|
| Container No | A | B | C | D | E | F |
| No. of Blows | 49 | 41 | 23 | | | |
| Moisture can and lid number | | | | | | |
| Mass of Empty can, m1 (g) | 14.3 | 14.6 | 14.8 | 15.5 | 14.2 | 14.9 |
| Mass of can + Moist Soil, m2 (g) | 15.4 | 16.7 | 16.9 | 16.8 | 16.5 | 16.1 |
| Mass of can + Dry Soil, m3 (g) | 15.1 | 16.2 | 16.4 | 16.6 | 16.1 | 15.9 |
| Mass of Soil (g) | 0.8 | 1.6 | 1.6 | 1.1 | 1.9 | 1 |
| Mass of Water (g) | 0.3 | 0.5 | 0.5 | 0.2 | 0.4 | 0.2 |
| Moisture Content (%) | 37.5 | 31.3 | 31.3 | 18.2 | 21.1 | 20.0 |
| **PI = 13.6** | **33.3** | | | **19.7** | | |

**Table 20: ATTERBERG LIMIT (LIQUID AND PLASTIC LIMITS )**

| Type of Test | Liquid Limit (LL) | | | | Plastic Limit (PL) | |
|---|---|---|---|---|---|---|
| Container No | A | B | C | D | E | F |
| No. of Blows | 49 | 41 | 23 | | | |
| Moisture can and lid number | | | | | | |
| Mass of Empty can, m1 (g) | 14.3 | 14.6 | 14.8 | NIL | NIL | NIL |
| Mass of can + Moist Soil, m2 (g) | 15.3 | 16.5 | 16.8 | NIL | NIL | NIL |
| Mass of can + Dry Soil, m3 (g) | 15.1 | 16.2 | 16.4 | NIL | NIL | NIL |
| Mass of Soil (g) | 0.8 | 1.6 | 1.6 | NIL | NIL | NIL |
| Mass of Water (g) | 0.2 | 0.3 | 0.4 | NIL | NIL | NIL |
| Moisture Content (%) | 25.0 | 18.8 | 25.0 | NIL | NIL | NIL |
| | **22.9** | | | | | |

**Table 38: The Co-Ordinates of the Study Area**

| S/N | Sample Location | Latitudes | Longitudes | Soil Description |
|---|---|---|---|---|
| 1 | L 1 | $07^0 50^0 847^1$ | $006^0 45^0.275^1$ | Fine grain laterite reddish soil |
| 2 | L 2 | $07^0 50^0 677^1$ | $006^0 45^0.328^1$ | Blackish medium soil |
| 3 | L 3 | $07^0 49^0 861^1$ | $006^0 44^0.955^1$ | Blackish sandy soil |
| 4 | L 4 | $07^0 48^0 825^1$ | $006^0 45^0.040^1$ | Clayey reddish |
| 5 | L 5 | $07^0 49^0 722^1$ | $006^0 45^0.995^1$ | Laterite medium grain soil |
| 6 | L 6 | $07^0 49^0 246^1$ | $006^0 44^0.994^1$ | Laterite medium grain soil |
| 7 | L 7 | $07^0 49^0 407^1$ | $006^0 44^0.994^1$ | Sandy Blackish soil |
| 8 | L 8 | $07^0 49^0 246^1$ | $006^0 44^0.246^1$ | Sandy Blackish soil |
| 9 | L 9 | $07^0 49^0 095^1$ | $006^0 44^0.964^1$ | Fine grain reddish soil |

**Table 40: Summary of Compaction Test Results of the Study Area**

| S/N | Location | Soil Description | Max dry Density (kg/m) | Optimum Moisture Content % | Specific Gravity S.G |
|---|---|---|---|---|---|
| 1 | L 1 | **Medium to Coarse Sand** | **1537** | **14.2** | **2.4** |
| 2 | L 2 | **Medium to Coarse Sand** | **2339** | **12.2** | **2.6** |
| 3 | L 3 | **Medium to Coarse Sand** | **2009** | **12.2** | **4.0** |
| 4 | L 4 | **Medium to Coarse Sand** | **970** | **11.0** | **2.8** |
| 5 | L 5 | **Medium to Coarse Sand** | **1146** | **25.2** | **3.3** |
| 6 | L 6 | **Medium to Coarse Sand** | **904** | **17.6** | **2.9** |
| 7 | L 7 | **Medium to Coarse Sand** | **970** | **9.6** | **3.4** |
| 8 | L 8 | **Medium to Coarse Sand** | **895** | **18.5** | **2.8** |
| 9 | L 9 | **Medium to Coarse Sand** | **895** | **18.5** | **2.9** |

## IV. DISCUSSION

The result of the research is presented in Table 1- 40 and fig. 1-2

**1 The Atterberg Limit Test**

From the summary of plasticity Index results in table 39 which ranges from 4.1% to 13.6%, soil samples in this study area have low to medium plasticity and will not posses problem when use for any engineering construction as stated by Burnister (1947).

Liquid Limit is the minimum of water that a soil sample will contain before it begin to flow as Liquid. The sample at location 6and 9 have liquid limit of 19.3 and 23.0 which are excellent for construction, while other samples location ranges from 24.0 to 44.0% which are not suitable for any engineering construction.

Samples at location 5 has plasticity limit of 11.6% which that of location 6 is 9.8%, and these values will not have any effect on structures soil samples at location 2.3 and 4 have average plasticity limit of 36.4 and is not suitable for any engineering construction.

**Particle Sizes Distribution**

The distribution of particles in a soil is represented by grading curves on a particle size distribution chart, as shown in fig. 5-12 more than 50% of the samples in all the locations fall within medium to coarse grained sand from the rounded nature of the grains,

It shows that it is well sorted and graded.

**Plasticity Characteristics After Burnister (1947)**

| Plasticity Index (%) | Plasticity |
|---|---|
| 0 | Non plastic |
| 1-5 | Slight |
| 6 – 10 | Low |
| 11 – 20 | Medium |
| 21 – 40 | Thigh |
| >40 | Very thigh |

**Department Of Scientific Industrial Research, (1965)**

| Average value of | | Maximum dry density from standard compaction Test kg/m3 | Suability of soil for construction of embankments |
|---|---|---|---|
| LL | PL | | |
| >65 | >22 | <1600 | Not suitable to very poor |
| 65 -50 | 22 – 19 | 1600 – 1730 | Poor |
| 49 -32 | 18 -16 | 1731 -1920 | Fair good |
| 31 -24 | 15 -14 | 1921 -2060 | Excellent |
| <24 | <14 | >2060 | |

**Maximum Dry Density**

In term of maximum dry density, samples 3 from location 1,2,3 have values of 1537kg/m, 2339kg/m3 and 2009kg/m3 and they are excellent for roads and other engineering work but samples gotten from locations: 4,5,6,7,8,9 are less than 1000kg/m3 on average and are not good to be use as a construction material.

**4.2.6 Rainfall Values From 1995 – 2014:**

The rainy season is from April to September while the dry season varies from October to March each year. From the data obtained from National Meteorological Center Lokoja (2017) shows that the rainfall in August 2009 was 369.8mm while that of September the same year was 255.8mm and that of October was 206.8mm. The excessive precipitation that year leads to the flood that occurred that year.

**4.2.7 Specific Gravity**

Specific gravity is the ratio of density of a substance to the density of a reference substance. The reference substance is always water. The specific gravity of the soil samples in all the 9 locations visited during the research varies from 2.4 to 4.0

## V. EFFECT OF FLOODS IN RELATION TO GEOTECHNICAL PROPERTIES OF SOIL AND HUMAN ACTIVITIES

Flood occurs when the soil, stream channels and manmade reservoirs cannot absorb or contain all the water. The town of Lokoja and its river bank was flooded as a result of the released water from Ladgo dam in Cameroon into the river Benue flood plain, and a similar released from Kainji, Jebba and Shiroro dam into river Niger in 2009 and 2012. So many researchers stated that climate change was responsible for these excess rainfalls in the recent time.

The effects of the flooding was very devastating than imagine. The river transgressed by about 10m from the shore line into the road close to the river bank at the old market. So many houses were submerged with attendant lost of life and properties to flood. Vehicular movement was disrupted for some days.

Commercial activities in the area was brought to a halt. Peoples have to result to canoes for transportation and to cross from one end of the town to the other.

The positive effect of the flood is that the clay and sitty component have been washed away by the flood, leaving the soil of mainly Gandy component.

The sharp sand was used by the construction workers for blocks moulding some tippers can be seen coming to Tip some of the sands for road construction and sand filling.

The river brought some reptiles such as snakes to where peoples are inhabiting, which is very dangerous to the inhabitant. Even the farm land was spared during the flood as farmers have to count their losses after the whole episode.

## VI. CONCLUSION

According to AASHTO classification, if more than 35% of the soil passes through sieve no 200 BS sieve such soils are generally high in silt and clay and can be classified as fair to poor materials, According to the federal ministry o f work and housings requirement (1997) if the percentage of soil materials passing through sieve no 200 is greater than 35% no need for further test and the materials should be rejected except they are improved upon by using any of the methods of soil stabilization techniques such as grouting, compaction, dewatering etc

Soils of all locations have percentage passing through sieve number 200 BS below 35% and as such considered good for engineering functions except for Location 6 which has percentage passing through sieve number 200 above 35% are considered fair to poor because of its high silt qualities and so therefore is ignored or improved

According to the guidance of the federal ministry of works (1997) the liquid limit should not exceed 35% to be suitable to be used as sub base or base course materials

Soils which have liquid limit less than 35% can be used as sub base or base course materials

Soils of locations five, six, seven, eight, nine has liquid limit of less than 35% and can be used as sub grade, base-base or base course materials while soils of locations one, two, three and four has liquid limit greater than 35% and so cannot be used as sub-grade or base course materials

It has been established that the causes of flooding are as follows:

- ❖ The release of water from the ladgo dam in Cameroon.
- ❖ The high rainfall in 2012 experienced in Lokoja and its environ.
- ❖ The housing development or urbanization of Lokoja which make the land unable to absorb excessive precipitation experienced in the area.

Another cause of flooding is the climate changes which resulted attendant in high temperature ($41^0$c) evaporation high humidity and finally precipitations have been responsible for excessive rainfall within the period.

From the results of the research work, I can conclude that the flooding have devastating effects on the plants and animals in the environment for the following reasons.

- ❖ Plants are submerged, including farm lands.
- ❖ Many animals lost their lives to the flood.

From the results of the various analysis carried out in the laboratory it was inferred that soil samples at Location 6 and Location 9 which is mainly grain sand have liquid limit (LL) of 19.3% and 23.0% obtained which are good for construction, while sands obtained from other Locations have Liquid limit that ranges from 24% to 44% and are not too suitable for construction.

## RECOMMENDATION

The followings are suggested to prevent flood and its attendant effects on people and the environment

1) The inhabitant of the river bank should be evacuated to a higher altitude
2) Farmers should desist from cultivating farm at the flood plain
3) Government should construct low cost housing for people that will be evacuated from there as a motivation.
4) Government should not allow construction companies from Tipping sand from the river band as these will further devastate the Environment
5) Government should construct main drainages and cannels for the floods
6) Government and private companies should construct. Small dam on the flood channels to prevent flood

## REFERENCES


[1]. **Babalola , J. S (1997 )** The June 24th 1995 Flood in Ondo Its Antecedent and incident Ife, Research Publication in Geography. Vol 6, Nos 1& 2.

[2]. **Eni, D. l., Attu, J. E Oko, C.o and Ekwok 1. (2011).** 'Flood and its impact in far lads in ltgidi, abi local government area, cross river state, Nigeria''. International journal of humanity and social science vol 1 no. 9 pp 98-104.

[3]. **Flood Management in Australia (1998:81)** Managing the flood plain-Australian institute for Disaster.

[4]. **Kofo A.A (2012).** Qualitative studying of real floods and sustainable growth and development of cities and towns in Nigeria'' International Journal of Humanity & Social Vol. 1 NO.9 PP 98-104

[5]. **Nott J. 2006.** Extreme Events A physical Recouetruction & Pick Assessment, Canbridge University Press. New York

[6]. **Nwilo, Olayinka and Adzandeh, 2012.** Flood Modeling and vulnerability assessment of settlements in the floodplains using GIS and Cellular framework approach. Global Journal of human social sciences, Vol 12, Issue 3.

**[7].** **Olivera et al (1995).** Predicting the water balance of surface and Groundwater Resources over large areas. Paper presented by UNESCO symposium on Runoff computations for water projects, St Petersburg, Russia, October 30th- November 3th.

[8]. **Oriola, E.O (2000).** Flooding and flood management In Jimoh, H.I & Ifabiyi, IP. (eds) contemporary issues in Environmental Studies. Ilorin Haytee Press & Publishing co. Ltd

[9]. **Social -Economic indications and public perception** (Punch July 11, 2011 on Urban Flooding in Lagos Nigeria).

[10]. **Sule, Y. M., Matazu, M. B., David, A. A., and Mabel, C. (2014);** Application of Geospatial techniques in flood risk and vulnerability mapping. For disaster management at Lokoja, kogi state Nigeria journal of environment and tart Science. Vol. 49 pp 66


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