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Effects of Human Activities on Water Quality of Lamingo Dam: Implication for Water Production

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Abstract: **This study examines the effects of human activities on water quality in Lamingo dam, field study was carried out to ascertain how human activities affect the quality of water of the dam between 2013 and 2014. The analysis carried out included physico-chemical analysis. Surveys were carried out to find out from the inhabitants their daily occupation and other activities normally undertaken around the reservoirs that might affect the water quality, the survey identified some of the activities the inhabitants undertook as farming, fishing, cement blocks moulding, cattle rearing, car wash etc. The laboratory results of water samples collected from the dam revealed that the level of total suspended solids (TSS), total dissolved solids (TDS), pH, dissolved oxygen (DO), chemical oxygen demand (COD), temperature, electrical conductivity, turbidity, hardness, benzene, cyanide, mercury and cadmium in the water sample were quite high. With the exception of pH , all other physico-chemical parameters measured are between 100% and 120% higher and have exceeded the maximum permissible limit given by the National Standard Water Quality (Nigeria) and World Health Organization (WHO). Presence of some of these pollutants, at various points of the dam, was observed and level of these pollutants at varying degrees was found. These and other high levels of some of the parameters were attributed to poor sanitation, improper farming methods such as excess use of fertilizers, improper fishing practices and discharge of domestic waste into the dam.**

Keywords: **Lamingo Dam, Water quality, Human activities, Physio-chemical, Socio-economic activities.**

I. INTRODUCTION

Water is an important element for all human beings in the world. Our body consists mostly of water. We need water for drinking, cooking, washing, agriculture and to run our industries. We usually take it for granted because of its availability, but when in scarcity it becomes our most precious resources. Water is one of the essential needs of man. As early as 1500 B.C, a Greek Philosopher's finding stated that water is the best of all things. Water is therefore a vital requirement for the existance of man (Medie, 2002).

According to figures recently issued by the World Health Organization (WHO) an average of 50,000 people die each day from diseases associated with contaminated water, that is one person every second. This is a grim reminder of how much we need potable water. In its natural state, water shows marked difference in quality depending on the type and location of sources. Generally speaking, groundwater is clear and odourless, especially if it is deep. It also contains low amount of suspended solids owing to filtration through the rocks, but it may be alkaline in reaction and highly mineralized for the same reason. The temperature regime of groundwater is virtually constant throughout the year and there is a decrease in the already low dissolved oxygen content as one moves further away from outer crust, with result, that the water becomes progressively de-oxygenated (Vanderhoeck, 2001).

The quality of surface water is rather more variable than that of groundwater. Water temperature varies in sympathy with seasonal and diurnal fluctuation in air temperature. Surface water is more easily polluted by man than the groundwater. Water pollution occurs mostly as a result of effluent disposal from homes and industries. In many developing countries, urban water courses have been converted to open sewers carrying effluent disposed from homes and industries. It should be noted that water, both surface and underground, can also be polluted by natural causes, surface streams may carry silt, waste, animals and vegetal matter derived from the land while groundwater in limestone areas is hard.

The World Health Organization (WHO, 2006.) has prescribed the quality expected of potable water. Most sources of water supply will require varying degrees of treatment before the standards specified can be attained. Water required for other uses such as irrigation, requires less stringent criteria. The characteristics measured or observed at surface water and groundwater quality stations vary a great deal but they generally include the following:

i. Physical characteristics: colour, turbidity, temperature, taste, odour.
ii. Chemical characteristics: pH, total hardness, presence of toxic substances dissolved such other substance as copper, iron, magnesium, manganese, zinc and sulphate.
iii. Biological characteristics: Coliform counts, algae counts biochemical's Oxygen demand (BOD) and dissolved oxygen American Public Health Association (1995) in determining water quality.

Availability of adequate water supply for drinking, cooking, washing, personal hygiene and other domestic purposes is essential for healthy survival of every community. The provision of potable water is one of the duties of the government to its citizens. Water scarcity is one of the major problems encountered by people of study area, just like in other parts of the state and many urban and rural centers in Nigeria.

The construction of dam and a reservoir is considered as the most effective means of solving human problems of water storage in sub-humid and arid region as Adams, (2000) asserted in the savanna area. Recently there are appreciable numbers of large and small dams that are constructed in different parts of Nigeria. There are socio-economic consequences in area where they are being constructed.

These schemes bring about some negative and positive socio-economic effects like farming activities , fishing activities, swimming, boat riding, training of students from different schools, car washing, block industries, increase health hazard especially those associated with water as well as psychological shock due to physical displacement and relocation of the affected population. The quality of life and convenience largely depends on the domestic water supply, increase in hygienic condition in the area would reduce the risk of water borne disease.

The most important thing which this study seeks to find out is the impact of people activities on the dam, particularly with reference to the socio- economic condition of the people in the construction of the dam.

Aim and Objectives

The aim of the study is to examine the impacts of the socio-economic activities of the people of Jos area on water quality of Lamingo dam. Thus, the main aim is achieved through the following objectives.

- To identify the various human activities taking place within the dam area.
- To examine the impacts of these activities on water quality of the dam.
- To compare the quantity of pollutants in the water with the acceptable limits of National Standard and WHO
- To suggest possible ways of reducing the human impacts and improving water quality of the dam.

The Study Area

Jos, a city in the middle belt of Nigeria, is located on lat.$9^0$56'N and long.$8^0$53'E. It is situated almost at the geographical center of Nigeria and about 179 km (111 miles) from Abuja the nation's capital. It is linked by road, rail and air to the rest of the country. It is the administrative capital of Plateau State. The city is located on the Jos Plateau at an elevation of about 1,238 meters/4,062 feet high above sea level. Jos the headquarters of Plateau State is bounded by Kaduna state to the north and northwest and Bauchi to the east, as shown in figure in 1.

For effective and clear comprehensive background of geographical area especially on the socio-economic impacts, Lamingo dam is an earth dam meant for urban water supply. It is within the hydrological zone of north central region of Nigeria. There are major tributaries that supply water to Lamingo dam which are collectively known as "RAFIN SANYE". Lamingo dam was constructed in 1973 and was constructed by Plateau State government. The dam has a height

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of 15.72m and a length of 3.62km with a storage capacity of 90,000m^3 per day, Lamingo dam supplies 15.5% of the water supplied to Jos area. There was no case of resettlement as the dam was built on vacant land.

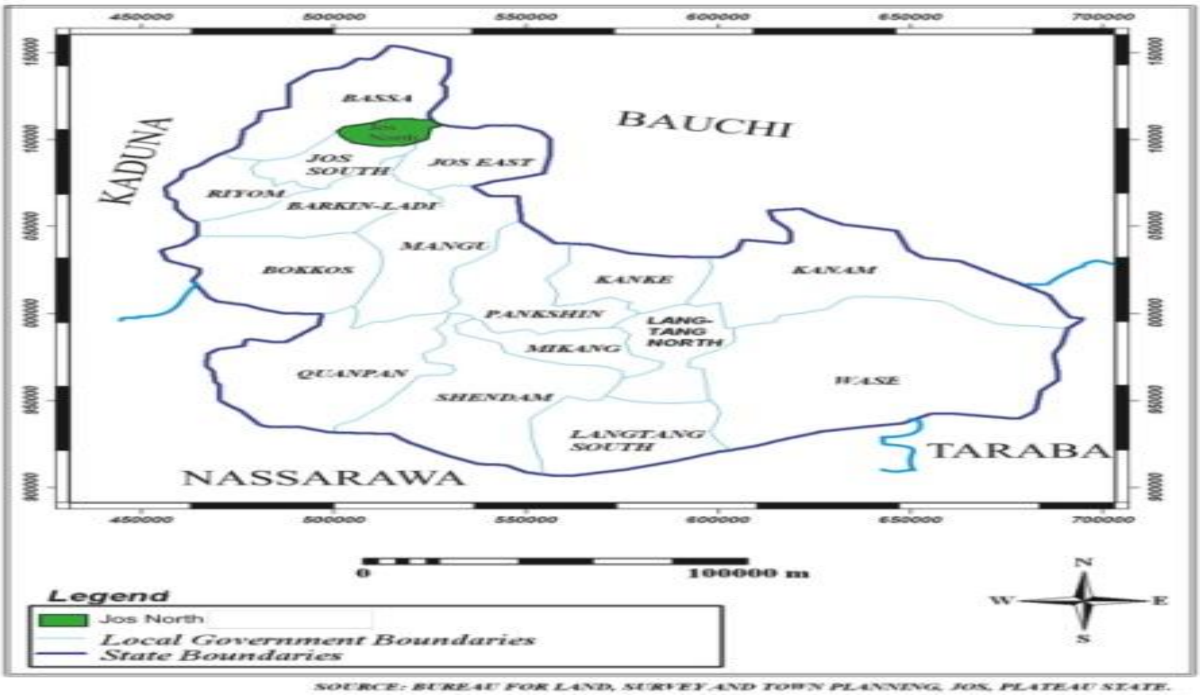

Figure 1: Map of Plateau State showing Jos North Local Government Area

AREIAL PHOTOGRAPH OF LAMINGO DAM

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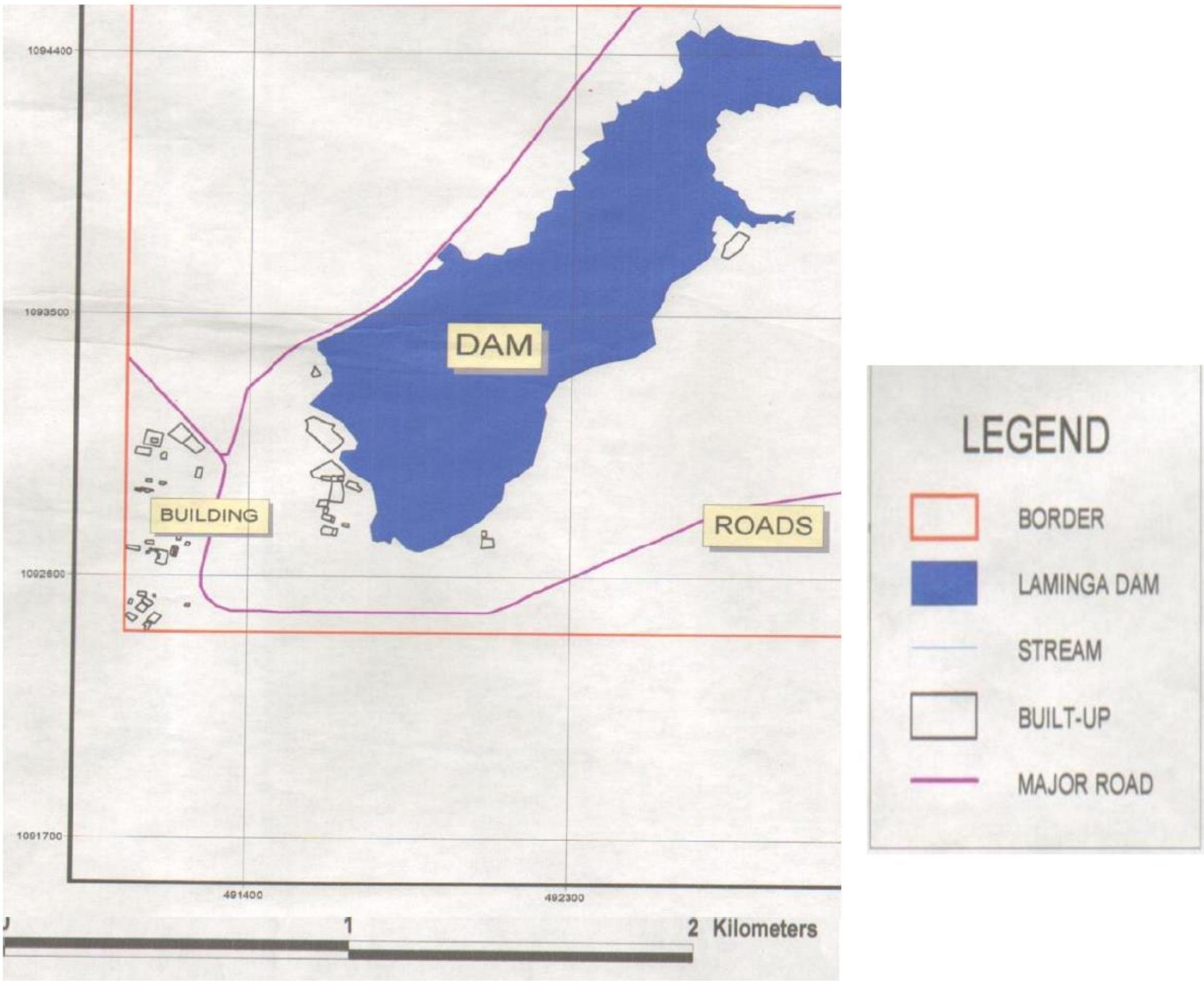

MAP OF LAMINGO DAM

II. MATERIALS AND METHOD

Transect walk was undertook throughout the catchments areas to observe the land use and socio-economic activities near the dam. Water samples were collected for two years 2013 to 2014 both in the rainy and dry seasons. The dam was stratified into three zones namely; downstream, midstream and upstream. Water samples were taken from these zones by sitting in canoe through these points. Collection of water samples was done in the morning between 8am and 9am. Theses samples were collected using Grab method which according to World Bank (1988); Samples were collected into clean 1 litre plastic bottles and were stored in an ice box of 4ºC and were taken to the laboratory within twenty-four hours for analysis. Water samples were collected by lowering pre- cleaned plastic bottles into the bottom of the water body, 30 cm deep, and allowed to over flow before withdrawing. Thus, three samples were collected during the rainy season (July 2013), three during the dry season (March 2013), another three during the rainy season (August 2014) and the three six during the dry season (November 2014). Parameters investigated are those indicating effects of human socio-economic activities on water quality.

III. RESULTS AND DISCUSSION

By the transect walk and recognizance survey undertaken by the authors, the socio-economic activities found to be taking place in the study area are activities like cement block molding, fishing, irrigation, mechanic workshop, nomadic farming and car wash, as show the plates 1, 2, 3, 4 and 5 below.

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Plate 1: BLOCK INDUSTRY

Plate 2: MECHANIC WORKSHOP

Plate 3: CAR WASH

Plate 4: NOMADIC FARMING

Plate 5: IRRIGATION FARMING

Table 1: Mean Values of Physio-chemical parameters for two years (2013-2014)

Parameter	Points of collecting water samples			Maximum Permissible Limits	
	Up Stream	Mid Stream	Down Stream	National Standard	WHO
Dissolved Oxygen (mg/l)	4	6	6	10	10
Biochemical Oxygen Demand (mg/l)	12	11	14	10	10
Chemical Oxygen Demand (mg\l)	45	50	53	40	40
Dissolved Solids (mg/l)	256	270	270	200	200
Suspended Solids (mg/l)	45	60	65	30	30
Total Solids (mg/l)	162	162	165	150	NA
Conductivity ($^{\upsilon}$m/cm)	300	300	310	240	250
Ph	5.0	5.4	6.0	6.5-8	6.5-8
Temperature (^{o}C)	28	28	30	30	30

Turbidity (NTU[1])	6	5	5	5	5
Benzene (mg/l)	2.1	2.1	2.5	NA	0.001
Cyanide (mg/l)	0.5	0.6	0.6	NA	0.7
Mercury (mg/l)	0.5	0.6	0.6	NA	0.001
Cadmium (mg/l)	0.02	0.15	0.08	NA	0.003

*Source: Laboratory analysis 2014 * National Standard (NIGERIA) and World Health Organization maximum acceptable limits. NA= Not Available*

The table reveals that the Dissolved Oxygen (DO) content of the water samples indicated that it is less than maximum permissible limit. The concentration of Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) do not conform with the maximum acceptable limit for inland waters as earmarked by WHO (2004), as 10 mg/l and 40 mg/l are the respective acceptable limits, even the upstream values shows 12 mg/l and 45 mg/l respectively for BOD and COD. From the table, the values of Dissolved Solids obtained are quite high in all the sample collection points up stream, mid stream and downstream of the dam. The suspended solids also remained at high at all sample collections points throughout the entire periods of study as against the National Standard acceptable limit of 30 mg/l, upstream, the value recorded was 45 mg/l. For electrical conductivity the results indicated that no sample point was anything close to National Standard acceptable limits as values of all points were high and well above National Standard acceptable limit. From the table the pH values of the three sampling points deviates from the National Standard acceptable limit of 6.5 with the up stream point of being the highest with a value of 5.0. The table shows that the temperature of water samples at all collection points is said to be tolerable when compared to National Standard acceptable limits.

IV. CONCLUSION

From the above results and discussion it becomes obvious to say that the water in Lamingo dam has been contaminated by human activities, because there is difference of concentration of the pollutants at the up stream, mid stream anddown stream. Many of the parameters measured are still higher than the acceptable limit set by National Standard Nigeria and World Health Organization, it was found that these pollutants present in the dam reduce the effects of solar energy absorption, resulting in a lower rate of photosynthesis and slows down natural water purification processes and the long effect of this is environmental degradation and the implication of this is that the Plateau State Water Board (PSWB) will spend more on water treatment for it to become portable. Plateau Environmental Protection and Sanitation Agency (PEPSA) should ensure that human activities and waste disposal complies with National Environmental Standards and Regulations Enforcement Agency (NESREA) and National Standard Drinking Water Quality guidelines of domestic and industrial waste discharge.

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